architects + engineers

PROJECT SPECIFICATIONS

HARRISON CENTRAL SCHOOL DISTRICT
50 UNION AVENUE
HARRISON, NEW YORK 10528

FITNESS CENTER ADDITION AT

HARRISON HIGH SCHOOL
255 UNION AVENUE
HARRISON, NEW YORK, 10528

SED CONTROL No.: 66-05-01-06-0-011-048

CONTRACT G – GENERAL CONSTRUCTION WORK
CONRTACT E – ELECTRICAL CONSTRUCTION WORK
CONTRACT P – PLUMBING CONSTRUCTION WORK
CONTRACT H – HVAC CONSTRUCTION WORK

H2M Project No: HCSD 2401E

FINAL BID DOCUMENT

JUNE 2026

H2M Architects + Engineers
538 Broad Hollow Road, 4th Floor East, Melville, NY 11747
tel 631.756.8000 fax 631.694.4122

www.h2m.com

The design of this project conforms to all applicable provision of the New York State Uniform Fire Prevention and Building Code, the New York State Energy Conservation Code, and the building standards of the New York State Education Department.

HARRISON CENTRAL SCHOOL DISTRICT
FITNESS CENTER ADDITION AT
HARRISON HIGH SCHOOL
SED No.: 66-05-01-06-0-011-048

CONTRACT G – GENERAL CONSTRUCTION WORK

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END OF SECTION

Notice is hereby given that SEALED PROPOSALS for:

RFB #26/27-14:
HARRISON CENTRAL SCHOOL DISTRICT
FITNESS CENTER ADDITION AT
HARRISON HIGH SCHOOL
SED No.: 66-05-01-06-0-011-048

CONTRACT G – GENERAL CONSTRUCTION WORK
CONTRACT E – ELECTRICAL CONSTRUCTION WORK
CONTRACT P – PLUMBING CONSTRUCTION WORK
CONTRACT H – HVAC CONSTRUCTION WORK

will be received until **11:30 A.M. on Thursday, July 23rd, 2026** at the **District Offices of the Harrison Central School District located at 50 Union Avenue, Harrison, NY 10528, 914-630-3011,** where the bids will be publicly opened and read aloud.

Complete Digital Sets of Bidding Documents, Plans and Specifications, may be obtained online as a download at the following website: h2mplanroom.com for a nonrefundable fee of One Hundred Dollars ($100.00) for each combined set of documents. Plans and Specifications may be obtained from REVplans, 28 Church Street, Unit 7, Warwick, New York 10990, upon deposit of **One Hundred Dollars ($100.00)** beginning **WEDNESDAY, JUNE 24TH, 2026,** for each combined set of documents. Checks or money orders shall be made payable to **HARRISON CENTRAL SCHOOL DISTRICT**, checks should be sent directly to REVplans. Bidder's deposit will be refunded if the set is returned to REV in good condition within thirty (30) days following the award of the contract or the rejection of the bids covered by such plans and specifications. **Non-bidders** shall receive partial reimbursement, in an amount equal to the amount of the deposit, less the actual cost of reproduction of the documents if the set is returned in good condition within thirty (30) days following the award of the contract or the rejection of the bids covered by such plans and specifications. Any bidder requiring documents to be shipped shall make arrangements with the printer and pay for all packaging and shipping costs.

Please note REVplans h2mplanroom.com is the designated location and means for distributing and obtaining all bid package information. Only those Contract Documents obtained in this manner will enable a prospective bidder to be identified as an official plan holder of record. The Provider takes no responsibility for the completeness of Contract Documents obtained from other sources. Contract Documents obtained from other sources may not be accurate or may not contain addenda that may have been issued

All bid addenda will be transmitted to registered plan holders via email and will be available at h2mplanroom.com Plan holders who have paid for hard copies of the bid documents will need to make the determination if hard copies of the addenda are required for their use and coordinate directly with the printer for hard copies of addenda to be issued. There will be no charge for registered plan holders to obtain hard copies of the bid addenda.

Bids must be made on the standard proposal form in the manner designated therein and as required by the specifications that must be enclosed in sealed opaque envelopes bearing the name of the job and name and address of the bidder on the outside, addressed to: **"PURCHASING AGENT, HARRISON CENTRAL SCHOOL DISTRICT",** clearly marked on the outside, **"FITNESS CENTER ADDITION AT HARRISON HIGH SCHOOL, SED: 66-05-01-06-0-011-048"**. The School District is not responsible for bids opened prior to the bid opening if bid number and opening date do not appear on the envelope. Bids opened prior to date and time indicated are invalid. The bidder assumes the risk of any delay in the mail, or in the handling of the mail by employees of the Harrison Central School District, as well as of improper hand delivery.

Each proposal submitted must be accompanied by a certified check or bid bond, made payable to the "**HARRISON CENTRAL SCHOOL DISTRICT**", in an amount equal to ten percent (10%) of the total amount of the bid, as a commitment by the bidder that, if its bid is accepted, it will enter into a contract to perform the work and will execute such further security as may be required for the faithful performance of the contract. **Certification of bonding company is required for this bid, see Instructions for Bidders.**

Each bidder shall agree to hold his/her bid price for ninety (90) days after the formal bid opening.

A pre-bid conference and walk through is scheduled for **Tuesday July 7th, 2026 at 11:30 A.M**. Potential bidders are asked to gather at the main entrance of Harrison High School, at which time they shall be escorted to the area of work. This meeting is not mandatory; however, it is highly recommended that all potential bidders attend.

It is the Board's intention to award the contract to the lowest qualified bidder in compliance with the specifications providing the required security who can meet the experience, technical and budget requirements. The Board reserves the right to reject any or all bids, waive any informality and to accept such bid which, in the opinion of the Board, is in the best interests of the School District.

By Order of the Board of Education
Harrison Central School District
50 Union Avenue
Harrison, New York 10528

Timothy Whipple
Assistant Superintendent for Business

BIDS FOR PROJECT

The Board of Education of the **Harrison Central School District** (hereafter called School District), will receive **SEALED PROPOSALS** for:

HARRISON CENTRAL SCHOOL DISTRICT
FITNESS CENTER ADDITION AT
HARRISON HIGH SCHOOL
SED No.: 66-05-01-06-0-011-048

CONTRACT G – GENERAL CONSTRUCTION WORK
CONTRACT E – ELECTRICAL CONSTRUCTION WORK
CONTRACT P – PLUMBING WORK
CONTRACT H – HVAC WORK

TIME AND PLACE

The sealed proposals are to be submitted at the:

HARRISON CENTRAL SCHOOL DISTRICT
ADMINISTRATION OFFICE
50 UNION AVENUE
HARRISON, NEW YORK 10528

See notice to bidders for all dates and times.

REQUIRED BID SUBMISSIONS

Each bid submission shall consist of two (2) sealed envelopes containing the following items. The bidder shall carefully remove all forms from the project specification. The project manual should not be submitted or included in the bid package.

Envelope No. 1 - BID PROPOSAL:

This envelope shall be clearly marked with the name of the project, bidders name and marked "**BID PROPOSAL**" in large lettering on the envelope and shall contain the following items:

1. Certified check or Bid Bond in the amount totaling 10% of the base bid.

2. Certified letter from Bonding Company, indicating that they meet the criteria set forth in article 11 of the General Conditions.

3. Certified letter that the company bidding this project has been in business under the same name for a period of five years or longer, and is not currently disbarred from bidding or working on public works projects by the New York State Department of Labor.

4. One (1) fully executed original and one (1) copy (marked "copy") of the following:

    a. Proposal forms (P-sheets).

    b. Original fully executed Non-Collusive Certification Form.

c. Original fully executed Hold Harmless Form.

d. In accordance with the requirements of the General Municipal Law S103-g, the bidder is required to include with its bid either (1) the "Certification of Compliance with the Iran Divestment Act" or in the case where the bidder is unable to make such certification, (2) the form titled, "Declaration of Bidder's Inability to Provide Certification of Compliance with the Iran Divestment Act".

e. Original fully executed Sexual Harassment Prevention Certification.

f. Original fully executed Insurance Coverage Certification.

g. Original fully executed Labor Law 220-I Certification Form and copy of Certificate(s) of Registration.

Envelope No. 2 - BID QUALIFICATIONS:

This envelope shall be clearly marked with the name of the project, bidders name and marked "**BID QUALIFICATIONS**" in large lettering on the envelope and shall contain the following items:

1. A description of its experience with projects of comparative size, complexity and cost together with documentary evidence showing that said projects were completed to the Owner's satisfaction and were completed in a timely fashion.

2. Documentation from five projects completed within the past five years:

   a. timeliness of performance of the work of the project.

   b. evidence that the project was completed to the Owner's satisfaction.

   c. whether any extensions of time were requested and if such requests were granted.

   d. whether litigation and/or arbitration was commenced by either the Owner or the bidder as a result of the work of the project completed by the bidder.

   e. whether any liens were filed on the project by subcontractors or material suppliers of the bidder.

   f. whether the bidder was defaulted on the project by the owner.

   g. whether the bidder made any claims for extra work on the project, including whether said claim resulted in a change order.

3. Documentation evidencing the bidder's financial responsibility, including a certified financial statement.

3. Fully completed statement of bidder's qualification.

DETERMINATION OF BIDDERS

In the consideration and acceptance of any proposal, the School District shall be entitled to exercise every measure of lawful discretion in evaluating the financial history and ability of the Bidder and its past performance in ventures of this or similar nature. Such data will be considered either as a material or controlling factor in the acceptance of any bid submitted.

1. Bidders must prove to the satisfaction of the School District that they are reputable, reliable and responsible.

2. The School District may make any investigation it deems necessary to assure itself of the ability of the Bidder to perform the work.

3. The School District reserves the right to reject any or all proposals and to accept the proposal it deems in the best interest of the School District.

DEPOSITS

Bidders deposit will be refunded if the set is returned in good condition within thirty (30) days following the award of the contract or the rejection of the bids covered by such plans and specifications. Non-bidders shall receive partial reimbursement, in an amount equal to the amount of the deposit, less the actual cost of reproduction of the documents if the set is returned in good condition within thirty (30) days following the award of the contract or the rejection of the bids covered by such plans and specifications.

VERBAL ANSWERS

The School District, its agents, servants, employees and the Architect/Engineer shall not be responsible in any manner for **verbal** answers to inquiries made regarding the meaning of the contract documents, drawings or the specifications prior to the awarding of the contract.

For information with reference to the work and its location during bid phase by prospective bidders' questions shall be submitted in writing to:

Kelly Kuplicki, RA, NCARB
Assistant Studio Director | Associate
H2M Architects + Engineers
538 Broad Hollow Road, 4th Floor East
Melville, NY 11747
Phone: (631) 756-8000 x1326
Fax: (631) 694-4122
E-mail: kkuplicki@h2m.com

To be given consideration, questions must be received in writing at least ten (10) days prior to the date fixed for the opening of bids.

ADDENDA AND INTERPRETATIONS

No interpretations of the meaning of the plans, specifications or other Contract Documents will be made to any bidder orally. Every request for such interpretation shall be made in writing, addressed to:

Kelly Kuplicki, RA, NCARB
Assistant Studio Director | Associate
H2M Architects + Engineers
538 Broad Hollow Road, 4th Floor East
Melville, NY 11747
Phone: (631) 756-8000 x1326
Fax: (631) 694-4122
E-mail: kkuplicki@h2m.com

To be given consideration, questions must be received in writing at least ten (10) days prior to the date fixed for the opening of bids. Any and all interpretations and any supplement instructions will be in the form of written addenda to the specifications, and will be sent by mail or faxed to each of the Contractors who has taken out the Drawings and Contract Documents.

All addenda so issued shall become part of the Contract Documents. If any addenda may materially affect the bid, as solely determined by the District, the District may extend the bid date.

PRE-BID INSPECTION OF SITE

Each bidder shall conduct on-site inspections of the referenced project site during the pre-bid walkthrough prior to submission of a bid proposal. The bidder shall acquaint himself/herself with all apparent conditions and characteristics of the facility with regard to assessment of required materials quantities, evaluation of quality of existing materials, access to the site and equipment's, location of underground utilities, clearances and all related information necessary to develop an understanding of the required scope of the work and all field conditions. Bidders must satisfy themselves by personal examination of the location of the proposed work and of the actual conditions and requirements of the work and shall not, at any time after the submission of the Proposal, dispute or complain of such estimate or assert there was any misunderstanding in regard to the depth or character or the nature of the work to be done. No consideration will be given for subsequent additional claims by the contractor of award after bidding with regard to apparent field conditions.

PRE-BID CONFERENCE

See Section "Notice to Bidders"

BIDDER TO BE FAMILIAR WITH PLANS AND REQUIREMENTS

It is the bidder's responsibility to carefully examine the plans and specifications, proposal and the site upon which the work is to be performed. A proposal submitted shall be prima facie evidence that the bidder has made such examination and that he/she is familiar with all of the conditions and requirements.

PREPARATION OF PROPOSAL

The Proposal forms for project contained herein must be used in preparing bids. Failure to use said Proposal forms or the inclusion of bids not requested shall result in rejection of the bid.

No proposal shall be received by the **Harrison Central School District** unless the bidder tendering same is known to be skilled in work of a similar nature to that envisaged in the Proposal.

Each bidder shall fill out in ink (in both words and figures) and signed by an officer of the corporation in the spaces provided, its unit or lump sum bid, as the case may be, for each item in the Proposal. If there is a discrepancy between the prices in words and figures, the prices in words shall govern as unit and lump sum prices.

No bid will be considered which does not include bids for all items listed in the proposal sheets.

NAME OF BIDDER

Each bidder must state in the Proposal its full name and business address, and the full name of every person, firm or corporation interested therein and the address of every person or firm, or president and secretary of every corporation interested with it; if no other person, firm or corporation be so interested, it must affirmatively state such fact. The Bidder must also state that the Proposal is made without any connection (directly or indirectly) with any other bidder for the work mentioned in its proposal and is (in all respects) without fraud or collusion; it has inspected the site of the work, has examined the Contract, General Conditions, Specifications, Plans, all addenda, and Information for Bidders; no person acting for or employed by the school district is directly or indirectly interested therein, or in the supplies or work to which it relates or in any portion of the prospective profits thereof; it proposes and agrees if its proposal or bid is accepted, to execute a contract with the school district to perform the work mentioned in the contract, plans and specifications attached; and the amount it will accept in full payment.

CERTIFIED CHECK OR BID BOND/BONDING CERTIFICATION

Each bid must be accompanied by either a certified check drawn on a solvent bank with an office in the State of New York, or a bid bond equal to ten percent (10 %) of the total amount of the project bid, and payable to the "**HARRISON CENTRAL SCHOOL DISTRICT**". This amount shall be the measure of liquidated damages sustained by the School District as a result of the failure, negligence or refusal of the Bidder to whom the contract is awarded to execute and deliver the contract. Provide a certified statement that the bonding company meets or exceeds the requirements set forth in Article 11 of the General Conditions.

A Performance and Payment bond will be required for the work. Each shall be in the amount of 100% of the contract sum. Refer to Article 11 of the General Conditions for requirements associated with such bonds.

PERMITS AND REGULATIONS

Each Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. Each Contractor is required to observe all laws and ordinances including, but not limited to, relating to the obstructing of streets, maintaining signals, keeping open passageways and protecting them where exposed to danger, and all general ordinances affecting him, his employees, or his work hereunder in his relations to the Owner or any person. Each contractor shall also obey all laws and ordinances controlling or limiting the Contractor while engaged in the prosecution of the work under this Contract.

If the Contractor observes that the drawings and specifications are at variance with laws and regulations, he/she shall promptly notify the Architect in writing and any necessary changes shall be adjusted as provided in the contract for changes in the work. If the Contractor performs any work knowing it be contrary to such laws, ordinances, rules, regulations, or specifications, or local, state or federal authorities without such notice to the Architect, he/she bear all costs arising there-from.

CONTRACTOR'S UNDERSTANDING

It is understood and agreed that the Contractor has, by careful examination, satisfied himself/herself as to the nature and location of the Work, and confirmation of the ground, the character, quality and quantity of the materials to be encountered, the character of equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions, and all other matters which can in any way affect the work under this contract.

No official, officer or agent of the Owner is authorized to make any representations as to the materials or workmanship involved or the conditions to be encountered and the Contractor agrees that no such statement or the evidence of any documents or plans, not a part of this contract, shall constitute any grounds for claim as to conditions encountered. No verbal agreement or conversation with any officer, agent or employee of the Owner either before or after the execution of this Contract, shall affect or modify any of the terms or obligations herein contained.

It is understood and agreed that the Contractor has informed himself fully as to the conditions relating to construction and labor under which the work will be performed and agrees as far as possible to employ such methods and means in the performance of his work so as not to cause interruption or interference with any other Contractor.

EQUIVALENTS

A. In the Specifications, one or more kinds, types, brands, or manufacturers or materials are regarded as the required standard of quality and are presumed to be equal. The contractor may select one of these items or, if the contractor desires to use any kind type, brand, or manufacturer or material other than those named in the specifications, they shall indicate in writing when requested, and prior to award of contract, what kind, type, brand or manufacturer is included in the base bid for the specified item.

B. Submission for equivalents shall be submitted to the Architect prior to the award of the contract.

C. Refer to Article 6(W) of the General Conditions for submission requirements. Contractor shall provide the Architect with the same documentation as required for substituted materials as set forth in Article 6(X) of the General Conditions.

BID EVALUATION

The Owner and Architect may make such investigation as they deem necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish the Owner with all such additional information and data for this purpose as may be requested. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligations of the Contract and to complete the work contemplated therein.

NOTICE OF ACCEPTANCE

The School District shall give notice of acceptance of a bid by either registered or certified mail, sent within forty five (45) days after the bids have been opened.

SIGNING OF CONTRACT

Each Bidder to whom a contract is awarded, shall, at the office of the School District within ten (10) business days after the date of notification by either registered or certified mail of acceptance of its proposal furnish the required payment and performance bonds in an amount of 100% of the contract, and the required insurance as set forth in Article 10 of the General Conditions, and sign the contract for the work for its performance and maintenance.

INSURANCE

The amounts, types and clauses to be included in the insurance is required to be carried by the successful bidder and its contractors, are listed as set forth in Article 10 of the General Conditions.

WAIVER OF IMMUNITY

Attention is directed to the statement of non-collusion required by Article 5A of the "General Municipal Law of the State of New York" concerning Waiver of Immunity and included in the attached Agreement.

RESPONSIBILITY OF BIDDER

The attention of Bidders is directed particularly to the contract provisions whereby the Contractor will be responsible for any loss or damage that may occur to the work or any part thereof during its progress and whereby the Contractor must make good any defects or faults in the work that may occur during the progress or within two (2) years after its acceptance.

Each Contractor shall provide for the continuation of the Performance Bond as a Maintenance Bond for two (2) full years after date of final payment request at the full contract price.

The work is to be performed and completed to the satisfaction of the Owner & Architect/Engineer and in accordance with the specifications annexed hereto and the plans referred to therein.

LABOR RATES

Each Contractor shall pay not less than the minimum hourly wage rates on those contracts as established in accordance with Section 220 of the Labor Law as shown in the schedule.

Article 8, Section 220 of the Labor Law, as amended by Chapter 750 of the Laws of 1956, provides (among other things) that it shall be the duty of the fiscal officer to make a determination of the schedule of wages to be paid to all laborers, workers and mechanics employed on public work projects, including supplements for welfare, pension, vacation and other benefits. These supplements include hospital, surgical or medical insurance, or benefits; life insurance or death benefits; accidental death or dismemberment insurance; and pension or retirement benefits. If the amount of supplements provided by the employer is less than the total supplements shown on the wage schedule, the difference shall be paid in cash to the employee.

Article 8, Section 220 of the Labor Law, as amended by Chapter 750 of the Laws of 1956, also provides that the supplements to be provided to laborers, workers and mechanics upon public work, "...shall be in

accordance with the prevailing practices in the locality..." The amount for supplements listed on the enclosed schedule does not necessarily include all types of prevailing supplements in the locality, and a future determination of the Industrial Commissioner may require the Contractor to provide additional supplements.

The original payrolls or transcripts shall be preserved for three (3) years from the completion of the work on the awarded project by the Contracts. The School District shall receive such payroll record upon completion of project.

Harrison Central School District
Board of Education
50 Union Avenue
Harrison, New York 10528

QUALIFICATIONS OF BIDDERS

Experience and Qualifications of the Bidder: Each bidder is required to submit the following documentation to demonstrate its experience and qualifications for the work of the Project for which a bid is submitted.

a. A description of its experience with projects of comparative size, complexity, and cost, together with documentary evidence showing that said projects were completed to the Owner's satisfaction and were completed in a timely fashion;

b. Documentation from each of the projects it has performed capital work in the last five (5) years concerning the bidder's:

   (i) Timeliness of performance of the work of the project;

   (ii) Evidence that the project was completed to the Owner's satisfaction;

   (iii) Whether or not any extensions of time were requested by the contractor and whether or not such requests were granted;

   (iv) Whether litigation and/ or arbitration was commenced by either the Owner or the bidder as result of the work of the project performed by the bidder;

   (v) Whether any liens were filed on the project by subcontractors or material suppliers of the bidder;

   (vi) Whether the bidder was defaulted on the project by the owner;

   (vii) Whether the bidder made any claims for extra work on the project, including whether said claim resulted in a change order;

c. Documentation evidencing the bidder's financial responsibility, including a certified financial statement prepared by a certified public accountant.

d. Documentation evidencing the bidder's existence under the same name for the last five (5) years.

STATEMENT OF BIDDER'S QUALIFICATIONS

IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE ANSWER TO ALL OF THE QUESTIONS IN THIS STATEMENT. IN THE EVENT A COMPLETE ANSWER IS NOT PROVIDED, THE BID WILL BE REJECTED.

1. Name of Bidder

_____

2. Type of Business Entity

_____

3. If the bidder is a corporation, state the date and place of incorporation of the corporation.

_____

4. For how many years has the bidder done business under its present name?

_____

5. List the persons who are directors, officers, owners, managerial employees or partners in the bidder's business.

_____

_____

_____

_____

_____

6. Have any of the persons listed in Number 5 owned/ operated/ been shareholders in any other companies: If so, please state name of owned/operated/been shareholders and names of other companies:

_____

_____

_____

7. If the answer to number 6 is in the affirmative, list said persons and the names of their previous affiliations.

8. Has any director, officer, owner or managerial employee had any professional license suspended or revoked? If the answer to this question is yes, list the name of the individual, the professional license he/she formerly held, whether said license was revoked or suspended and the date of the revocation or suspension.

9. Has the bidder been found guilty of any OSHA Violations? If the answer to this question is yes, describe the nature of the OSHA violation, an explanation of remediation or other steps taken regarding such violation(s).

10. Has the bidder been charged with any claims pertaining to unlawful intimidation or discrimination against any employee by reason of race, creed, color, disability, sex or natural origin and/or violations of an employee's civil rights or equal employment opportunities? If the answer to this question is yes, list the persons making such claim against the bidder, a description of the claim, the status of the claim, and what disposition (if any) has been made regarding such claim.

11. Has the bidder been named as a party in any lawsuit arising from performance of work related to any project in which it has been engaged? If the answer to this question is yes, list all such lawsuits, the index number associated with said suit and the status of the lawsuit at the time of the submission of this bid.

12. Has the bidder been the subject of an investigation and/or proceedings before the Department of Labor for alleged violations of the Labor Law as it relates to the payment of prevailing wages and/or supplemental payment requirements? If the answer to this question is yes, please list each such instance of the commencement of a Department of Labor proceeding, for which project such proceeding was commenced, and the status of the proceeding at the time of the submission of this bid.

13. Has the bidder been the subject of an investigation and/or proceeding before any law enforcement agency, including, but not limited to any District Attorney's Office? If the answer to this question is yes, please list each such instance, the law enforcement agency, the nature of the proceeding, the project for which such proceeding was commenced, if applicable to a project, and the status of the proceeding at the time of the submission of this bid.

14. Has the bidder been the subject of proceedings involving allegations that it violated the Workers' Compensation Law including but not limited to the failure to provide proof of worker's compensation or disability coverage and/or any lapses thereof. If the answer to this question is yes, list each such instance of violation and the status of the claimed violation at the time of the submissions of this bid.

15. Has the bidder, its officers, directors, owner and/or managerial employees been convicted of a crime or been the subject of a criminal indictment during the five years preceding the submission of this bid? If the answer to this question is yes, list the name of the individual convicted or indicted, the charge against the individual and the date of disposition of the charge.

16. Has the bidder been charged with and/or found guilty of any violations of federal, state, or municipal environmental and/or health laws, codes, rules and/or regulations? If the answer to this question is yes, list the nature of the charge against the bidder, the date of the charge, and the status of the charge at the time of the submission of this bid.

17. Has the bidder bid on any projects for the period September 1, 2012 to present? If the answer to this question is yes, list the projects bid on, whether said bid was awarded to the bidder and the expected date of commencement of the work for said project. For those projects listed, if the bidder was not awarded the contract, state whether the bidder was the lowest monetary bidder.

    IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE LIST OF PROJECTS AS REQUIRED BY THIS QUESTION #17 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.

18. Does the bidder have any projects ongoing at the time of the submission of this bid? If the answer to this question is yes, list the projects on which the bidder is currently working, the percentage complete, and the expected date of completion of said project.

    IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE LIST OF PROJECTS AS REQUIRED BY THIS QUESTION #18 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.

19. Has the bidder ever been terminated from a Project by the Owner? If the answer to this question is yes, list the projects on which the bidder was terminated, the nature of the termination (convenience, suspension, for cause), and the date of said termination.

    IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE LIST OF PROJECTS AS REQUIRED BY THIS QUESTION #19 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.

20. Has the bidder's surety ever been contacted to provide supervisory services in connection with an on-going project. If the answer to this question is yes, list the project(s) for which the surety provided supervisory services.

    IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE LIST OF PROJECTS AS REQUIRED BY THIS QUESTION #20 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.

By: _____ _____
(Signature) (Dated)

_____
(Print Name and Title)

Sworn to before me this

_____ day of _____, 20__.

_____
(Notary Public)

May 2019

IN ACCORDANCE WITH ARTICLE 8, SECTION 220 (3-a) OF THE NEW YORK STATE LABOR LAW, THE FOLLOWING LINK REPRESENTS THE MOST CURRENT PREVAILING WAGE RATE SCHEDULES AT THE TIME OF BIDDING, ISSUED BY THE NEW YORK STATE DEPARTMENT OF LABOR SPECIFICALLY REQUESTED FOR THIS PROJECT:

(PRC# 2026008672 – Fitness Center Addition)

https://apps.labor.ny.gov/wpp/publicViewProject.do?method=showIt&id=1571243

CONTRACTOR IS TO OBTAIN THE PREVAILING WAGE RATES GENERATED FOR THIS PROJECT AT THE NEW YORK STATE DEPARTMENT OF LABOR WEBSITE.

- ASSEMBLY BILL NUMBER 1839
- NOTICES REGARDING WAGE RATE UPDATES
- WAGE RATE SCHEDULE
- LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED PUBLIC WORK

Harrison Central School District
Board of Education
50 Union Avenue
Harrison, New York 10528

IN ACCORDANCE WITH ARTICLE 8, SECTION 220 (3-a) OF THE NEW YORK STATE LABOR LAW, THE FOLLOWING LINK REPRESENTS THE MOST CURRENT PREVAILING WAGE RATE SCHEDULES AT THE TIME OF BIDDING, ISSUED BY THE NEW YORK STATE DEPARTMENT OF LABOR SPECIFICALLY REQUESTED FOR THIS PROJECT:

(PRC# 2024007730 – Additions and Alterations at Harrison High School)

https://apps.labor.ny.gov/wpp/publicViewProject.do?method=showIt&id=1571243

CONTRACTOR IS TO OBTAIN THE PREVAILING WAGE RATES GENERATED FOR THIS PROJECT AT THE NEW YORK STATE DEPARTMENT OF LABOR WEBSITE.

- ASSEMBLY BILL NUMBER 1839
- NOTICES REGARDING WAGE RATE UPDATES
- WAGE RATE SCHEDULE
- LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED PUBLIC WORK

Harrison Central School District
Board of Education
50 Union Avenue
Harrison, New York 10528

Kathy Hochul, Governor

Roberta Reardon, Commissioner

Harrison Central SD

Melissa Hoereth
538 Broad Hollow Road
4th Floor East
Melville NY 11747

Schedule Year	2024 through 2025
Date Requested	06/24/2024
PRC#	2024007730

Location	Harrison High School
Project ID#	HCSD2401E
Project Type	three one-story additions and a baseball field at Harrison High School

PREVAILING WAGE SCHEDULE FOR ARTICLE 8 PUBLIC WORK PROJECT

Attached is the current schedule(s) of the prevailing wage rates and prevailing hourly supplements for the project referenced above. A unique Prevailing Rate Case Number (PRC#) has been assigned to the schedule(s) for your project.

The schedule is effective from July 2024 through June 2025. All updates, corrections, posted on the 1st business day of each month, and future copies of the annual determination are available on the Department's website www.labor.ny.gov. Updated PDF copies of your schedule can be accessed by entering your assigned PRC# at the proper location on the website.

It is the responsibility of the contracting agency or its agent to annex and make part, the attached schedule, to the specifications for this project, when it is advertised for bids and /or to forward said schedules to the successful bidder(s), immediately upon receipt, in order to insure the proper payment of wages.

Please refer to the "General Provisions of Laws Covering Workers on Public Work Contracts" provided with this schedule, for the specific details relating to other responsibilities of the Department of Jurisdiction.

Upon completion or cancellation of this project, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

NOTICE OF COMPLETION / CANCELLATION OF PROJECT

Date Completed: _____ Date Cancelled: _____

Name & Title of Representative: _____

Phone: (518) 457-5589 Fax: (518) 485-1870
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12240

General Provisions of Laws Covering Workers on Article 8 Public Work Contracts

Introduction

The Labor Law requires public work contractors and subcontractors to pay laborers, workers, or mechanics employed in the performance of a public work contract not less than the prevailing rate of wage and supplements (fringe benefits) in the locality where the work is performed.

Responsibilities of the Department of Jurisdiction

A Department of Jurisdiction (Contracting Agency) includes a state department, agency, board or commission: a county, city, town or village; a school district, board of education or board of cooperative educational services; a sewer, water, fire, improvement and other district corporation; a public benefit corporation; and a public authority awarding a public work contract.

The Department of Jurisdiction (Contracting Agency) awarding a public work contract MUST obtain a Prevailing Rate Schedule listing the hourly rates of wages and supplements due the workers to be employed on a public work project. This schedule may be obtained by completing and forwarding a "Request for wage and Supplement Information" form (PW 39) to the Bureau of Public Work. The Prevailing Rate Schedule MUST be included in the specifications for the contract to be awarded and is deemed part of the public work contract.

Upon the awarding of the contract, the law requires that the Department of Jurisdiction (Contracting Agency) furnish the following information to the Bureau: the name and address of the contractor, the date the contract was let and the approximate dollar value of the contract. To facilitate compliance with this provision of the Labor Law, a copy of the Department's "Notice of Contract Award" form (PW 16) is provided with the original Prevailing Rate Schedule.

The Department of Jurisdiction (Contracting Agency) is required to notify the Bureau of the completion or cancellation of any public work project. The Department's PW 200 form is provided for that purpose.

Both the PW 16 and PW 200 forms are available for completion online.

Hours

No laborer, worker, or mechanic in the employ of a contractor or subcontractor engaged in the performance of any public work project shall be permitted to work more than eight hours in any day or more than five days in any week, except in cases of extraordinary emergency. The contractor and the Department of Jurisdiction (Contracting Agency) may apply to the Bureau of Public Work for a dispensation permitting workers to work additional hours or days per week on a particular public work project.

Wages and Supplements

The wages and supplements to be paid and/or provided to laborers, workers, and mechanics employed on a public work project shall be not less than those listed in the current Prevailing Rate Schedule for the locality where the work is performed. If a prime contractor on a public work project has not been provided with a Prevailing Rate Schedule, the contractor must notify the Department of Jurisdiction (Contracting Agency) who in turn must request an original Prevailing Rate Schedule form the Bureau of Public Work. Requests may be submitted by: mail to NYSDOL, Bureau of Public Work, State Office Bldg. Campus, Bldg. 12, Rm. 130, Albany, NY 12226; Fax to Bureau of Public Work (518) 485-1870; or electronically at the NYSDOL website www.labor.ny.gov.

Upon receiving the original schedule, the Department of Jurisdiction (Contracting Agency) is REQUIRED to provide complete copies to all prime contractors who in turn MUST, by law, provide copies of all applicable county schedules to each subcontractor and obtain from each subcontractor, an affidavit certifying such schedules were received. If the original schedule expired, the contractor may obtain a copy of the new annual determination from the NYSDOL website www.labor.ny.gov.

The Commissioner of Labor makes an annual determination of the prevailing rates. This determination is in effect from July 1st through June 30th of the following year. The annual determination is available on the NYSDOL website www.labor.ny.gov.

Payrolls and Payroll Records

Every contractor and subcontractor MUST keep original payrolls or transcripts subscribed and affirmed as true under penalty of perjury. As per Article 6 of the Labor law, contractors and subcontractors are required to establish, maintain, and preserve for not less than six (6) years, contemperaneous, true, and accurate payroll records. At a minimum, payrolls must show the following information for each person employed on a public work project: Name, Address, Last 4 Digits of Social Security Number, Classification(s) in which the worker was employed, Hourly wage rate(s) paid, Supplements paid or provided, and Daily and weekly number of hours worked in each classification.

The filing of payrolls to the Department of Jurisdiction is a condition of payment.Every contractor and subcontractor shall submit to the Department of Jurisdiction (Contracting Agency), within thirty (30) days after issuance of its first payroll and every thirty (30) days thereafter, a transcript of the original payrolls, subscribed and affirmed as true under penalty of perjury. The Department of Jurisdiction (Contracting Agency) shall collect, review for facial validity, and maintain such payrolls.

In addition, the Commissioner of Labor may require contractors to furnish, with ten (10) days of a request, payroll records sworn to as their validity and accuracy for public work and private work. Payroll records include, but are not limited to time cards, work description sheets, proof that supplements were provided, cancelled payroll checks and payrolls. Failure to provide the requested information within the allotted ten (10) days will result in the withholding of up to 25% of the contract, not to exceed $100,000.00. If the contractor or subcontractor does not maintain a place of business in New York State and the amount of the contract exceeds $25,000.00, payroll records and certifications must be kept on the project worksite.

The prime contractor is responsible for any underpayments of prevailing wages or supplements by any subcontractor.

All contractors or their subcontractors shall provide to their subcontractors a copy of the Prevailing Rate Schedule specified in the public work contract as well as any subsequently issued schedules. A failure to provide these schedules by a contractor or subcontractor is a violation of Article 8, Section 220-a of the Labor Law.

All subcontractors engaged by a public work project contractor or its subcontractor, upon receipt of the original schedule and any subsequently issued schedules, shall provide to such contractor a verified statement attesting that the subcontractor has received the Prevailing Rate Schedule and will pay or provide the applicable rates of wages and supplements specified therein. (See NYS Labor Laws, Article 8 . Section 220-a).

Determination of Prevailing Wage and Supplement Rate Updates Applicable to All Counties

The wages and supplements contained in the annual determination become effective July 1st whether or not the new determination has been received by a given contractor. Care should be taken to review the rates for obvious errors. Any corrections should be brought to the Department's attention immediately. It is the responsibility of the public work contractor to use the proper rates. If there is a question on the proper classification to be used, please call the district office located nearest the project. Any errors in the annual determination will be corrected and posted to the NYSDOL website on the first business day of each month. Contractors are responsible for paying these updated rates as well, retroactive to July 1st.

When you review the schedule for a particular occupation, your attention should be directed to the dates above the column of rates. These are the dates for which a given set of rates is effective. To the extent possible, the Department posts rates in its possession that cover periods of time beyond the July 1st to June 30th time frame covered by a particular annual determination. Rates that extend beyond that instant time period are informational ONLY and may be updated in future annual determinations that actually cover the then appropriate July 1st to June 30th time period.

Withholding of Payments

When a complaint is filed with the Commissioner of Labor alleging the failure of a contractor or subcontractor to pay or provide the prevailing wages or supplements, or when the Commissioner of Labor believes that unpaid wages or supplements may be due, payments on the public work contract shall be withheld from the prime contractor in a sufficient amount to satisfy the alleged unpaid wages and supplements, including interest and civil penalty, pending a final determination.

When the Bureau of Public Work finds that a contractor or subcontractor on a public work project failed to pay or provide the requisite prevailing wages or supplements, the Bureau is authorized by Sections 220-b and 235.2 of the Labor Law to so notify the financial officer of the Department of Jurisdiction (Contracting Agency) that awarded the public work contract. Such officer MUST then withhold or cause to be withheld from any payment due the prime contractor on account of such contract the amount indicated by the Bureau as sufficient to satisfy the unpaid wages and supplements, including interest and any civil penalty that may be assessed by the Commissioner of Labor. The withholding continues until there is a final determination of the underpayment by the Commissioner of Labor or by the court in the event a legal proceeding is instituted for review of the determination of the Commissioner of Labor.

The Department of Jurisdiction (Contracting Agency) shall comply with this order of the Commissioner of Labor or of the court with respect to the release of the funds so withheld.

Summary of Notice Posting Requirements

The current Prevailing Rate Schedule must be posted in a prominent and accessible place on the site of the public work project. The prevailing wage schedule must be encased in, or constructed of, materials capable of withstanding adverse weather conditions and be titled "PREVAILING RATE OF WAGES" in letters no smaller than two (2) inches by two (2) inches.

The "Public Work Project" notice must be posted at the beginning of the performance of every public work contract, on each job site.

Every employer providing workers. compensation insurance and disability benefits must post notices of such coverage in the format prescribed by the Workers. Compensation Board in a conspicuous place on the jobsite.

Every employer subject to the NYS Human Rights Law must conspicuously post at its offices, places of employment, or employment training centers, notices furnished by the State Division of Human Rights.

Employers liable for contributions under the Unemployment Insurance Law must conspicuously post on the jobsite notices furnished by the NYS Department of Labor.

Apprentices

Employees cannot be paid apprentice rates unless they are individually registered in a program registered with the NYS Commissioner of Labor. The allowable ratio of apprentices to journeyworkers in any craft classification can be no greater than the statewide building trade ratios promulgated by the Department of Labor and included with the Prevailing Rate Schedule. An employee listed on a payroll as an apprentice who is not registered as above or is performing work outside the classification of work for which the apprentice is indentured, must be paid the prevailing journeyworker's wage rate for the classification of work the employee is actually performing.

NYSDOL Labor Law, Article 8, Section 220-3, require that only apprentices individually registered with the NYS Department of Labor may be paid apprenticeship rates on a public work project. No other Federal or State Agency of office registers apprentices in New York State.

Persons wishing to verify the apprentice registration of any person must do so in writing by mail, to the NYSDOL Office of Employability Development / Apprenticeship Training, State Office Bldg. Campus, Bldg. 12, Albany, NY 12226 or by Fax to NYSDOL Apprenticeship Training (518) 457-7154. All requests for verification must include the name and social security number of the person for whom the information is requested.

The only conclusive proof of individual apprentice registration is written verification from the NYSDOL Apprenticeship Training Albany Central office. Neither Federal nor State Apprenticeship Training offices outside of Albany can provide conclusive registration information.

It should be noted that the existence of a registered apprenticeship program is not conclusive proof that any person is registered in that program. Furthermore, the existence or possession of wallet cards, identification cards, or copies of state forms is not conclusive proof of the registration of any person as an apprentice.

Interest and Penalties

In the event that an underpayment of wages and/or supplements is found:

- Interest shall be assessed at the rate then in effect as prescribed by the Superintendent of Banks pursuant to section 14-a of the Banking Law, per annum from the date of underpayment to the date restitution is made.
- A Civil Penalty may also be assessed, not to exceed 25% of the total of wages, supplements, and interest due.

Debarment

Any contractor or subcontractor and/or its successor shall be ineligible to submit a bid on or be awarded any public work contract or subcontract with any state, municipal corporation or public body for a period of five (5) years when:

- Two (2) willful determinations have been rendered against that contractor or subcontractor and/or its successor within any consecutive six (6) year period.
- There is any willful determination that involves the falsification of payroll records or the kickback of wages or supplements.

Criminal Sanctions

Willful violations of the Prevailing Wage Law (Article 8 of the Labor Law) may be a felony punishable by fine or imprisonment of up to 15 years, or both.

Discrimination

No employee or applicant for employment may be discriminated against on account of age, race, creed, color, national origin, sex, disability or marital status.

No contractor, subcontractor nor any person acting on its behalf, shall by reason of race, creed, color, disability, sex or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates (NYS Labor Law, Article 8, Section 220-e(a)).

No contractor, subcontractor, nor any person acting on its behalf, shall in any manner, discriminate against or intimidate any employee on account of race, creed, color, disability, sex, or national origin (NYS Labor Law, Article 8, Section 220-e(b)).

The Human Rights Law also prohibits discrimination in employment because of age, marital status, or religion.

There may be deducted from the amount payable to the contractor under the contract a penalty of $50.00 for each calendar day during which such person was discriminated against or intimidated in violation of the provision of the contract (NYS Labor Law, Article 8, Section 220-e(c)).

The contract may be cancelled or terminated by the State or municipality. All monies due or to become due thereunder may be forfeited for a second or any subsequent violation of the terms or conditions of the anti-discrimination sections of the contract (NYS Labor Law, Article 8, Section 220-e(d)).

Every employer subject to the New York State Human Rights Law must conspicuously post at its offices, places of employment, or employment training centers notices furnished by the State Division of Human Rights.

Workers' Compensation

In accordance with Section 142 of the State Finance Law, the contractor shall maintain coverage during the life of the contract for the benefit of such employees as required by the provisions of the New York State Workers' Compensation Law.

A contractor who is awarded a public work contract must provide proof of workers' compensation coverage prior to being allowed to begin work.

The insurance policy must be issued by a company authorized to provide workers' compensation coverage in New York State. Proof of coverage must be on form C-105.2 (Certificate of Workers' Compensation Insurance) and must name this agency as a certificate holder.

If New York State coverage is added to an existing out-of-state policy, it can only be added to a policy from a company authorized to write workers' compensation coverage in this state. The coverage must be listed under item 3A of the information page.

The contractor must maintain proof that subcontractors doing work covered under this contract secured and maintained a workers' compensation policy for all employees working in New York State.

Every employer providing worker's compensation insurance and disability benefits must post notices of such coverage in the format prescribed by the Workers' Compensation Board in a conspicuous place on the jobsite.

Unemployment Insurance

Employers liable for contributions under the Unemployment Insurance Law must conspicuously post on the jobsite notices furnished by the New York State Department of Labor.

Kathy Hochul, Governor

Roberta Reardon, Commissioner

Harrison Central SD

Melissa Hoereth
538 Broad Hollow Road
4th Floor East
Melville NY 11747

Schedule Year 2024 through 2025
Date Requested 06/24/2024
PRC# 2024007730

Location Harrison High School
Project ID# HCSD2401E
Project Type three one-story additions and a baseball field at Harrison High School

Notice of Contract Award

New York State Labor Law, Article 8, Section 220.3a requires that certain information regarding the awarding of public work contracts, be furnished to the Commissioner of Labor. One "Notice of Contract Award" (PW 16, which may be photocopied), **MUST** be completed for **EACH** prime contractor on the above referenced project.

Upon notifying the successful bidder(s) of this contract, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

Contractor Information
All information must be supplied

Federal Employer Identification Number: _____

Name: _____

Address: _____

_____

City: _____ State: _____ Zip: _____

Amount of Contract: $_____

Approximate Starting Date: ____/____/____

Approximate Completion Date: ____/____/____

Contract Type:
[ ] (01) General Construction
[ ] (02) Heating/Ventilation
[ ] (03) Electrical
[ ] (04) Plumbing
[ ] (05) Other : _____

Phone: (518) 457-5589 Fax: (518) 485-1870
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12226

Social Security Numbers on Certified Payrolls:

The Department of Labor is cognizant of the concerns of the potential for misuse or inadvertent disclosure of social security numbers. Identity theft is a growing problem and we are sympathetic to contractors' concern regarding inclusion of this information on payrolls if another identifier will suffice.

For these reasons, the substitution of the use of the last four digits of the social security number on certified payrolls submitted to contracting agencies on public work projects is now acceptable to the Department of Labor. This change does not affect the Department's ability to request and receive the entire social security number from employers during its public work/ prevailing wage investigations.

Construction Industry Fair Play Act: Required Posting for Labor Law Article 25-B § 861-d

Construction industry employers must post the "Construction Industry Fair Play Act" notice in a prominent and accessible place on the job site. Failure to post the notice can result in penalties of up to $1,500 for a first offense and up to $5,000 for a second offense. The posting is included as part of this wage schedule. Additional copies may be obtained from the NYS DOL website, https://dol.ny.gov/public-work-and-prevailing-wage
If you have any questions concerning the Fair Play Act, please call the State Labor Department toll-free at 1-866-435-1499 or email us at: dol.misclassified@labor.ny.gov .

Worker Notification: (Labor Law §220, paragraph a of subdivision 3-a)

Effective June 23, 2020

This provision is an addition to the existing wage rate law, Labor Law §220, paragraph a of subdivision 3-a. It requires contractors and subcontractors to provide written notice to all laborers, workers or mechanics of the *prevailing wage and supplement rate* for their particular job classification *on each pay stub**. It also requires contractors and subcontractors to *post a notice* at the beginning of the performance of every public work contract *on each job site* that includes the telephone number and address for the Department of Labor and a statement informing laborers, workers or mechanics of their right to contact the Department of Labor if he/she is not receiving the proper prevailing rate of wages and/or supplements for his/her job classification. The required notification will be provided with each wage schedule, may be downloaded from our website *www.labor.ny.gov* or be made available upon request by contacting the Bureau of Public Work at 518-457-5589. *In the event the required information will not fit on the pay stub, an accompanying sheet or attachment of the information will suffice.

(12.20)

To all State Departments, Agency Heads and Public Benefit Corporations
IMPORTANT NOTICE REGARDING PUBLIC WORK ENFORCEMENT FUND

Budget Policy & Reporting Manual

B-610

Public Work Enforcement Fund

effective date December 7, 2005

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1. Purpose and Scope:

This Item describes the Public Work Enforcement Fund (the Fund, PWEF) and its relevance to State agencies and public benefit corporations engaged in construction or reconstruction contracts, maintenance and repair, and announces the recently-enacted increase to the percentage of the dollar value of such contracts that must be deposited into the Fund. This item also describes the roles of the following entities with respect to the Fund:

- New York State Department of Labor (DOL),
- The Office of the State of Comptroller (OSC), and
- State agencies and public benefit corporations.

2. Background and Statutory References:

DOL uses the Fund to enforce the State's Labor Law as it relates to contracts for construction or reconstruction, maintenance and repair, as defined in subdivision two of Section 220 of the Labor Law. State agencies and public benefit corporations participating in such contracts are required to make payments to the Fund.

Chapter 511 of the Laws of 1995 (as amended by Chapter 513 of the Laws of 1997, Chapter 655 of the Laws of 1999, Chapter 376 of the Laws of 2003 and Chapter 407 of the Laws of 2005) established the Fund.

3. Procedures and Agency Responsibilities:

The Fund is supported by transfers and deposits based on the value of contracts for construction and reconstruction, maintenance and repair, as defined in subdivision two of Section 220 of the Labor Law, into which all State agencies and public benefit corporations enter.

Chapter 407 of the Laws of 2005 increased the amount required to be provided to this fund to .10 of one-percent of the total cost of each such contract, to be calculated at the time agencies or public benefit corporations enter into a new contract or if a contract is amended. The provisions of this bill became effective August 2, 2005.

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IMPORTANT NOTICE REGARDING PUBLIC WORK ENFORCEMENT FUND

OSC will report to DOL on all construction-related ("D") contracts approved during the month, including contract amendments, and then DOL will bill agencies the appropriate assessment monthly. An agency may then make a determination if any of the billed contracts are exempt and so note on the bill submitted back to DOL. For any instance where an agency is unsure if a contract is or is not exempt, they can call the Bureau of Public Work at the number noted below for a determination. Payment by check or journal voucher is due to DOL within thirty days from the date of the billing. DOL will verify the amounts and forward them to OSC for processing.

For those contracts which are not approved or administered by the Comptroller, monthly reports and payments for deposit into the Public Work Enforcement Fund must be provided to the Administrative Finance Bureau at the DOL within 30 days of the end of each month or on a payment schedule mutually agreed upon with DOL.

Reports should contain the following information:

- Name and billing address of State agency or public benefit corporation;
- State agency or public benefit corporation contact and phone number;
- Name and address of contractor receiving the award;
- Contract number and effective dates;
- Contract amount and PWEF assessment charge (if contract amount has been amended, reflect increase or decrease to original contract and the adjustment in the PWEF charge); and
- Brief description of the work to be performed under each contract.

Checks and Journal Vouchers, payable to the "New York State Department of Labor" should be sent to:

Department of Labor
Administrative Finance Bureau-PWEF Unit
Building 12, Room 464
State Office Campus
Albany, NY 12226

Any questions regarding billing should be directed to NYSDOL's Administrative Finance Bureau-PWEF Unit at (518) 457-3624 and any questions regarding Public Work Contracts should be directed to the Bureau of Public Work at (518) 457-5589.

NEW YORK STATE OF OPPORTUNITY. Department of Labor

Required Notice under Article 25-B of the Labor Law

Attention All Employees, Contractors and Subcontractors: You are Covered by the Construction Industry Fair Play Act

The law says that you are an employee unless:

- You are free from direction and control in performing your job, **and**
- You perform work that is not part of the usual work done by the business that hired you, **and**
- You have an independently established business.

Your employer cannot consider you to be an independent contractor unless all three of these facts apply to your work.

It is against the law for an employer to misclassify employees as independent contractors or pay employees off the books.

Employee Rights: If you are an employee, you are entitled to state and federal worker protections. These include:

- Unemployment Insurance benefits, if you are unemployed through no fault of your own, able to work, and otherwise qualified,
- Workers' compensation benefits for on-the-job injuries,
- Payment for wages earned, minimum wage, and overtime (under certain conditions),
- Prevailing wages on public work projects,
- The provisions of the National Labor Relations Act, and
- A safe work environment.

It is a violation of this law for employers to retaliate against anyone who asserts their rights under the law. Retaliation subjects an employer to civil penalties, a private lawsuit or both.

Independent Contractors: If you are an independent contractor**, you must pay all taxes and Unemployment Insurance contributions required by New York State and Federal Law.**

Penalties for paying workers off the books or improperly treating employees as independent contractors:

• **Civil Penalty**	First offense: Up to $2,500 per employee Subsequent offense(s): Up to $5,000 per employee
• **Criminal Penalty**	First offense: Misdemeanor - up to 30 days in jail, up to a $25,000 fine and debarment from performing public work for up to one year. Subsequent offense(s): Misdemeanor - up to 60 days in jail or up to a $50,000 fine and debarment from performing public work for up to 5 years.

If you have questions about your employment status or believe that your employer may have violated your rights and you want to file a complaint, call the Department of Labor at (866) 435-1499 or send an email to dol.misclassified@labor.ny.gov. All complaints of fraud and violations are taken seriously. You can remain anonymous.

Employer Name:

IA 999 (09/16)

WE ARE YOUR DOL

NEW YORK STATE Department of Labor

New York State Department of Labor
Bureau of Public Work

Attention Employees

THIS IS A:

PUBLIC WORK PROJECT

If you are employed on this project as a **worker, laborer, or mechanic** you are entitled to receive the **prevailing wage and supplements rate** for the classification at which you are working.

Your pay stub and wage notice received upon hire must clearly state your wage rate and supplement rate.

Chapter 629 of the Labor Laws of 2007:

These wages are set by law and must be posted at the work site. They can also be found at: https://dol.ny.gov/bureau-public-work

If you feel that you have not received proper wages or benefits, please call our nearest office.*

Albany	(518) 457-2744	Patchogue	(631) 687-4882
Binghamton	(607) 721-8005	Rochester	(585) 258-4505
Buffalo	(716) 847-7159	Syracuse	(315) 428-4056
Garden City	(516) 228-3915	Utica	(315) 793-2314
New York City	(212) 932-2419	White Plains	(914) 997-9507
Newburgh	(845) 568-5287		

* For New York City government agency construction projects, please contact the Office of the NYC Comptroller at (212) 669-4443, or www.comptroller.nyc.gov – click on Bureau of Labor Law.

Contractor Name: _____

Project Location: _____

Requirements for OSHA 10 Compliance

Article 8 §220-h requires that when the advertised specifications, for every contract for public work, is $250,000.00 or more the contract must contain a provision requiring that every worker employed in the performance of a public work contract shall be certified as having completed an OSHA 10 safety training course. The clear intent of this provision is to require that all employees of public work contractors, required to be paid prevailing rates, receive such training “prior to the performing any work on the project.”

The Bureau will enforce the statute as follows:

All contractors and sub contractors must attach a copy of proof of completion of the OSHA 10 course to the first certified payroll submitted to the contracting agency and on each succeeding payroll where any new or additional employee is first listed.

Proof of completion may include but is not limited to:

- Copies of bona fide course completion card (*Note: Completion cards do not have an expiration date.)*
- Training roster, attendance record of other documentation from the certified trainer pending the issuance of the card.
- Other valid proof

**A certification by the employer attesting that all employees have completed such a course is not sufficient proof that the course has been completed.

Any questions regarding this statute may be directed to the New York State Department of Labor, Bureau of Public Work at 518-457-5589.

WICKS

Public work projects are subject to the Wicks Law requiring separate specifications and bidding for the plumbing, heating and electrical work, when the total project's threshold is $3 million in Bronx, Kings, New York, Queens and, Richmond counties; $1.5 million in Nassau, Suffolk and Westchester counties; and $500,000 in all other counties.

For projects below the monetary threshold, bidders must submit a sealed list naming each subcontractor for the plumbing, HVAC and electrical and the amount to be paid to each. The list may not be changed unless the public owner finds a legitimate construction need, including a change in specifications or costs or the use of a Project Labor Agreement (PLA), and must be open to public inspection.

Allows the state and local agencies and authorities to waive the Wicks Law and use a PLA if it will provide the best work at the lowest possible price. If a PLA is used, all contractors shall participate in apprentice training programs in the trades of work it employs that have been approved by the Department of Labor (DOL) for not less than three years. They shall also have at least one graduate in the last three years and use affirmative efforts to retain minority apprentices. PLA's would be exempt from Wicks, but deemed to be public work subject to prevailing wage enforcement.

The Commissioner of Labor shall have the power to enforce separate specification requirement s on projects, and may issue stop-bid orders against public owners for non-compliance.

Other new monetary thresholds, and similar sealed bidding for non-Wicks projects, would apply to certain public authorities including municipal housing authorities, NYC Construction Fund, Yonkers Educational Construction Fund, NYC Municipal Water Finance Authority, Buffalo Municipal Water Finance Authority, Westchester County Health Care Association, Nassau County Health Care Corp., Clifton-Fine Health Care Corp., Erie County Medical Center Corp., NYC Solid Waste Management Facilities, and the Dormitory Authority.

Contractors must pay subcontractors within a 7 days period.

(07.19)

Introduction to the Prevailing Rate Schedule

Information About Prevailing Rate Schedule

This information is provided to assist you in the interpretation of particular requirements for each classification of worker contained in the attached Schedule of Prevailing Rates.

Classification

It is the duty of the Commissioner of Labor to make the proper classification of workers taking into account whether the work is heavy and highway, building, sewer and water, tunnel work, or residential, and to make a determination of wages and supplements to be paid or provided. It is the responsibility of the public work contractor to use the proper rate. If there is a question on the proper classification to be used, please call the district office located nearest the project. District office locations and phone numbers are listed below.

Prevailing Wage Schedules are issued separately for "General Construction Projects" and "Residential Construction Projects" on a county-by-county basis.

General Construction Rates apply to projects such as: Buildings, Heavy & Highway, and Tunnel and Water & Sewer rates.

Residential Construction Rates generally apply to construction, reconstruction, repair, alteration, or demolition of one family, two family, row housing, or rental type units intended for residential use.

Some rates listed in the Residential Construction Rate Schedule have a very limited applicability listed along with the rate. Rates for occupations or locations not shown on the residential schedule must be obtained from the General Construction Rate Schedule. Please contact the local Bureau of Public Work office before using Residential Rate Schedules, to ensure that the project meets the required criteria.

Payrolls and Payroll Records

Contractors and subcontractors are required to establish, maintain, and preserve for not less that six (6) years, contemporaneous, true, and accurate payroll records.

Every contractor and subcontractor shall submit to the Department of Jurisdiction (Contracting Agency), within thirty (30) days after issuance of its first payroll and every thirty (30) days thereafter, a transcript of the original payrolls, subscribed and affirmed as true under penalty of perjury.

Paid Holidays

Paid Holidays are days for which an eligible employee receives a regular day's pay, but is not required to perform work. If an employee works on a day listed as a paid holiday, this remuneration is in addition to payment of the required prevailing rate for the work actually performed.

Overtime

At a minimum, all work performed on a public work project in excess of eight hours in any one day or more than five days in any workweek is overtime. However, the specific overtime requirements for each trade or occupation on a public work project may differ. Specific overtime requirements for each trade or occupation are contained in the prevailing rate schedules.

Overtime holiday pay is the premium pay that is required for work performed on specified holidays. It is only required where the employee actually performs work on such holidays.

The applicable holidays are listed under HOLIDAYS: OVERTIME. The required rate of pay for these covered holidays can be found in the OVERTIME PAY section listings for each classification.

Supplemental Benefits

Particular attention should be given to the supplemental benefit requirements. Although in most cases the payment or provision of supplements is straight time for all hours worked, some classifications require the payment or provision of supplements, or a portion of the supplements, to be paid or provided at a premium rate for premium hours worked. Supplements may also be required to be paid or provided on paid holidays, regardless of whether the day is worked. The Overtime Codes and Notes listed on the particular wage classification will indicate these conditions as required.

Effective Dates

When you review the schedule for a particular occupation, your attention should be directed to the dates above the column of rates. These are the dates for which a given set of rates is effective. The rate listed is valid until the next effective rate change or until the new annual determination which takes effect on July 1 of each year. All contractors and subcontractors are required to pay the current prevailing rates of wages and supplements. If you have any questions please contact the Bureau of Public Work or visit the New York State Department of Labor website (www.labor.ny.gov) for current wage rate information.

Apprentice Training Ratios

The following are the allowable ratios of registered Apprentices to Journey-workers.

For example, the ratio 1:1,1:3 indicates the allowable initial ratio is one Apprentice to one Journeyworker. The Journeyworker must be in place on the project before an Apprentice is allowed. Then three additional Journeyworkers are needed before a second Apprentice is allowed. The last ratio repeats indefinitely. Therefore, three more Journeyworkers must be present before a third Apprentice can be hired, and so on.

Please call Apprentice Training Central Office at (518) 457-6820 if you have any questions.

Title (Trade)	Ratio
Boilermaker (Construction)	1:1,1:4
Boilermaker (Shop)	1:1,1:3
Carpenter (Bldg.,H&H, Pile Driver/Dockbuilder)	1:1,1:4
Carpenter (Residential)	1:1,1:3
Electrical (Outside) Lineman	1:1,1:2
Electrician (Inside)	1:1,1:3
Elevator/Escalator Construction & Modernizer	1:1,1:2
Glazier	1:1,1:3
Insulation & Asbestos Worker	1:1,1:3
Iron Worker	1:1,1:4
Laborer	1:1,1:3
Mason	1:1,1:4
Millwright	1:1,1:4
Op Engineer	1:1,1:5
Painter	1:1,1:3
Plumber & Steamfitter	1:1,1:3
Roofer	1:1,1:2
Sheet Metal Worker	1:1,1:3
Sprinkler Fitter	1:1,1:2

If you have any questions concerning the attached schedule or would like additional information, please contact the nearest BUREAU of PUBLIC WORK District Office or write to:

New York State Department of Labor
Bureau of Public Work
State Office Campus, Bldg. 12
Albany, NY 12226

District Office Locations:	Telephone #	FAX #
Bureau of Public Work - Albany	518-457-2744	518-485-0240
Bureau of Public Work - Binghamton	607-721-8005	607-721-8004
Bureau of Public Work - Buffalo	716-847-7159	716-847-7650
Bureau of Public Work - Garden City	516-228-3915	516-794-3518
Bureau of Public Work - Newburgh	845-568-5287	845-568-5332
Bureau of Public Work - New York City	212-932-2419	212-775-3579
Bureau of Public Work - Patchogue	631-687-4882	631-687-4902
Bureau of Public Work - Rochester	585-258-4505	585-258-4708
Bureau of Public Work - Syracuse	315-428-4056	315-428-4671
Bureau of Public Work - Utica	315-793-2314	315-793-2514
Bureau of Public Work - White Plains	914-997-9507	914-997-9523
Bureau of Public Work - Central Office	518-457-5589	518-485-1870

Westchester County General Construction

Boilermaker — 03/01/2025

JOB DESCRIPTION Boilermaker **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

WAGES

Per Hour:	07/01/2024	01/01/2025
Boilermaker	$ 67.38	$ 68.88
Repairs & Renovations	67.38	68.88

Repairs & Renovation: Includes Repairing, Renovating replacement of parts to an existing unit(s).

SUPPLEMENTAL BENEFITS
Per Hour:

Boilermaker Repair & Renovations	33.5% of hourly Wage Paid + $ 26.85	33.5% of Hourly Wage Paid + $26.85

NOTE: "Hourly Wage Paid" shall include any and all premium(s) pay.

Repairs & Renovation Includes replacement of parts and repairs & renovation of existing unit.

OVERTIME PAY
See (*B, O, **U) on OVERTIME PAGE
Note:* Includes 9th & 10th hours, double for 11th or more.
** Labor Day ONLY, if worked.

Repairs & Renovation see (B,E,Q) on OT Page

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 12, 15, 25, 26, 29) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wage per hour:
(1/2) Year Terms at the following percentage of Boilermaker's Wage

1st	2nd	3rd	4th	5th	6th	7th
65%	70%	75%	80%	85%	90%	95%

Supplemental Benefits Per Hour:

	33.5% of Hourly Wage Paid Plus Amount Below	33.5% of Hourly Wage Paid Plus Amount Below
1st Term	$ 20.36	$ 20.36
2nd Term	21.28	21.28
3rd Term	22.22	22.22
4th Term	23.12	23.12
5th Term	24.07	24.07
6th Term	25.00	25.00
7th Term	25.93	25.93

NOTE: "Hourly Wage Paid" shall include any and all premium(s)

4-5

Carpenter — 03/01/2025

JOB DESCRIPTION Carpenter **DISTRICT** 8

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES
Per hour: 07/01/2024

Piledriver	$ 60.59
	+ 10.00*
Dockbuilder	$ 60.59
	+ 10.00*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 45.79

OVERTIME PAY
See (B, E2, O) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE.

Paid: for 1st & 2nd yr.
Apprentices See (5,6,11,13,25)

Overtime: See (5,6,11,13,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES
Wages per hour
(1)year terms:

1st	2nd	3rd	4th
$26.98	$32.58	$40.96	$49.35
+ 5.50*	+ 5.50*	+ 5.50*	+ 5.50*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

Supplemental benefits per hour:

All Terms: $ 32.34

8-1556 Db

Carpenter — 03/01/2025

JOB DESCRIPTION Carpenter **DISTRICT** 8

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES
Per hour: 07/01/2024

Carpet/Resilient	
Floor Coverer	$ 55.05
	+ 8.25*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

INCLUDES HANDLING & INSTALLATION OF ARTIFICIAL TURF AND SIMILAR TURF INDOORS/OUTDOORS.

SUPPLEMENTAL BENEFITS
Per hour:
$ 39.45

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (18, 19) on HOLIDAY PAGE.

Paid for 1st & 2nd yr.
Apprentices See (5,6,11,13,16,18,19,25)
Overtime: See (5,6,11,13,16,18,19,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES
Wage per hour - (1) year terms:

1st	2nd	3rd	4th
$ 25.20	$ 28.20	$ 32.45	$ 40.33

+ 1.85*	+ 2.35*	+ 2.85*	+ 3.85*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

Supplemental benefits per hour:

1st	2nd	3rd	4th
$ 15.22	$ 16.22	$ 19.32	$ 20.32

8-2287

Carpenter — 03/01/2025

JOB DESCRIPTION Carpenter **DISTRICT** 8

ENTIRE COUNTIES
Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES
Per Hour: 07/01/2024

Marine Construction:

Marine Diver	$ 75.46
	+ 10.00*
Marine Tender	$ 55.00
	+ 10.00*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime

SUPPLEMENTAL BENEFITS
Per Hour:

Journeyworker	$ 45.65

OVERTIME PAY
See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (18, 19) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 13, 16, 18, 19, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages per hour:
One (1) year terms.

1st year	$ 26.98
	+ 5.50*
2nd year	32.58
	+ 5.50*
3rd year	40.96
	+ 5.50*
4th year	49.35
	+ 5.50*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

Supplemental Benefits
Per Hour:

All terms	$ 32.20

8-1456MC

Carpenter — 03/01/2025

JOB DESCRIPTION Carpenter **DISTRICT** 8

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES
Per hour: 07/01/2024

Building
Millwright $ 59.35
+ 13.12*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

SUPPLEMENTAL BENEFITS
Per hour:

Millwright $ 45.41

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (18, 19) on HOLIDAY PAGE
Paid: See (18,19) on HOLIDAY PAGE.

Overtime See (5,6,8,11,13,18,19,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES
Wages per hour:
One (1) year terms:

1st.	2nd.	3rd.	4th.
$ 32.16	$ 37.61	$ 43.06	$ 53.96
+ 7.08*	+ 8.25*	+ 9.42*	+ 11.76*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

Supplemental benefits per hour:
One (1) year terms:

1st.	2nd.	3rd.	4th.
$ 30.56	$ 33.09	$ 36.27	$ 40.69

8-740.1

Carpenter **03/01/2025**

JOB DESCRIPTION Carpenter **DISTRICT** 8

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES
Per Hour:
07/01/2024

Timberman $ 55.59
+ 10.26*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

SUPPLEMENTAL BENEFITS
Per Hour:
07/01/2024

$ 44.96

OVERTIME PAY
See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY
Overtime: See (5, 6, 11, 13, 25) on HOLIDAY PAGE
Paid: See (1) on HOLIDAY PAGE.

Paid: for 1st & 2nd yr.
Apprentices See (5,6,11,13,25)

Overtime: See (5,6,11,13,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES
Wages per hour:
One (1) year terms:

1st	2nd	3rd	4th

$24.96	$30.07	$37.72	$45.38
+ 5.55*	+ 5.55*	+ 5.55*	+ 5.55*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

Supplemental benefits per hour:
All terms $ 31.95

8-1556 Tm

Carpenter 03/01/2025

JOB DESCRIPTION Carpenter **DISTRICT** 8

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Westchester

PARTIAL COUNTIES
Orange: South of but including the following, Waterloo Mills, Slate Hill, New Hampton, Goshen, Blooming Grove, Mountainville, east to the Hudson River.
Putnam: South of but including the following, Cold Spring, TompkinsCorner, Mahopac, Croton Falls, east to Connecticut border.
Suffolk: West of Port Jefferson and Patchogue Road to Route 112 to the Atlantic Ocean.

WAGES

Per hour:	07/01/2024
Core Drilling:	
Driller	$ 46.25 + 3.25*
Driller Helper	$ 36.28 + 3.25*

Note: Hazardous Waste Pay Differential:
For Level C, an additional 15% above wage rate per hour
For Level B, an additional 15% above wage rate per hour
For Level A, an additional 15% above wage rate per hour
Note: When required to work on water: an additional $ 3.00 per hour.

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

SUPPLEMENTAL BENEFITS

Per hour:	
Driller and Helper	$ 30.24

OVERTIME PAY
See (B, G, P) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

8-1536-CoreDriller

Carpenter - Building / Heavy&Highway 03/01/2025

JOB DESCRIPTION Carpenter - Building / Heavy&Highway **DISTRICT** 11

ENTIRE COUNTIES
Putnam, Rockland, Westchester

WAGES
WAGES:(per hour)
Applies to CARPENTER BUILDING/HEAVY & HIGHWAY/TUNNEL:

	07/01/2024	07/01/2025 Additional	07/01/2026 Additional
Base Wage	$ 42.76 +$6.62*	$ 1.25**	$ 1.25**

*For all hours paid straight or premium.
**To be allocated at a later date.

SHIFT WORK

SHIFT DIFFERENTIAL: When it is mandated by a Government Agency irregular or off shift can be worked. The Carpenter shall receive an additional fifteen percent (15%) of wage plus applicable benefits.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker $ 31.60

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
BUILDING:
Paid: See (1) on HOLIDAY PAGE.
Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE.
- Holidays that fall on Sunday will be observed Monday.

HEAVY&HIGHWAY/TUNNEL:
Paid: See (5, 6, 25) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
- Holidays that fall on Sunday will be observed Monday
- Must be employed during the five (5) work days immediately preceding a holiday or during the five (5) work days following the paid holiday to receive holiday pay
- If Employee is entitled to a paid holiday, the Employee is paid the Holiday wage and supplemental benefits whether they work or not. If Employee works the Holiday, the Employee will receive holiday pay (including supplemental benefits), plus the applicable premium wage for working the Holiday. If Employee works in excess of 8 hours on Holiday, then benefits will be paid for any hours in excess of 8 hours.

REGISTERED APPRENTICES
1 year terms at the following wage rates:

1st	2nd	3rd	4th
$ 21.38	$ 25.66	$ 29.93	$ 34.21
+3.84*	+3.84*	+3.84*	+3.84*

*For all hours paid straight or premium

SUPPLEMENTAL BENEFITS per hour:

All terms $ 16.25

11-279.1B/HH

Electrician **03/01/2025**

JOB DESCRIPTION Electrician **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond, Westchester

WAGES
Per hour: 07/01/2024

Service Technician $ 37.40

Service and Maintenance on Alarm and Security Systems.

Maintenance, repair and /or replacement of defective (or damaged) equipment on, but not limited to, Burglar - Fire - Security - CCTV - Card Access - Life Safety Systems and associated devices. (Whether by service contract of T&M by customer request.)

SUPPLEMENTAL BENEFITS
Per hour:
Journeyworker: $ 21.85

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 11, 15, 16, 17, 25, 26) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 15, 16, 17, 25, 26) on HOLIDAY PAGE

9-3H

Electrician **03/01/2025**

JOB DESCRIPTION Electrician **DISTRICT** 8

ENTIRE COUNTIES
Westchester

WAGES

Per hour:	07/01/2024	04/17/2025
*Electrician/A-Technician	$ 56.75	$ 58.75
Teledata	56.75	58.75

*All new installations of wiring, conduit, junction boxes and light fixtures for projects with a base bid of more than $325,000. For projects with a base bid of $325,000 or less, see Maintenance and Repair rates.

Note: On a job where employees are required to work on bridges over navigable waters, transmission towers, light poles, bosun chairs, swinging scaffolds , etc. 40 feet or more above the water or ground or under compressed air, or tunnel projects under construction or where assisted breathing apparatus is required, they will be paid at the rate of time and one-half for such work except on normal pole line or building construction work.

SUPPLEMENTAL BENEFITS

Per hour:		
Journeyworker	$ 59.39	$61.09

OVERTIME PAY
See (A, G, *J, P) on OVERTIME PAGE
*NOTE: Emergency work on Sunday and Holidays is at the time and one-half overtime rate.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
(1) year terms at the following wage rates:

	07/01/2024	01/01/2025	04/17/2025
1st term	$ 16.00	$ 16.50	$16.50
2nd term	17.00	17.00	17.00
3rd term	19.00	19.00	19.00
4th term	21.00	21.00	21.00
MIJ 1-12 months	26.50	26.50	26.50
MIJ 13-18 months	30.00	30.00	30.00

Supplemental Benefits per hour:

	07/01/2024	01/01/2025	04/17/2025
1st term	$ 12.40	$ 12.40	$ 12.72
2nd term	15.07	15.07	15.89
3rd term	16.40	16.40	17.23
4th term	17.73	17.73	18.57
MIJ 1-12 months	15.72	15.72	15.89
MIJ 13-18 months	16.17	16.17	16.29

8-3/W

Electrician — 03/01/2025

JOB DESCRIPTION Electrician **DISTRICT** 8

ENTIRE COUNTIES
Westchester

WAGES
Per hour

	07/01/2024	04/17/2025
Electrician -M	$ 30.00	$ 30.00
H - Telephone	30.00	30.00

All work with a base bid amount of $325,000 or less. Including repairs and /or replacement of defective electrical and teledata equipment, all work necessary to retrofit, service, maintain and repair all kinds of lighting fixtures and local lighting controls, and washing and cleaning of foregoing fixtures.

*If the project exceeds $375,000 due to changes in the scope of work, an Electrician/A Technician must be part of the labor ratio.

SUPPLEMENTAL BENEFITS

	07/01/2024	04/17/2025
Electrician & H - Telephone	$ 16.17	$ 16.29

OVERTIME PAY
See (B, G, *J, P) on OVERTIME PAGE
*Note: Emergency work on Sunday and Holidays is at the time and one-half overtime rate.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

8-3m

Elevator Constructor 03/01/2025

JOB DESCRIPTION Elevator Constructor **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

PARTIAL COUNTIES
Rockland: Entire County except for the Township of Stony Point
Westchester: Entire County except for the Townships of Bedford, Lewisboro, Cortland, Mt. Kisco, North Salem, Pound Ridge, Somers and Yorktown.

WAGES
Per hour:

	07/01/2024	03/17/2025
Elevator Constructor	$ 80.35	$ 83.37
Modernization & Service/Repair	63.16	65.54

SUPPLEMENTAL BENEFITS
Per Hour:

Elevator Constructor	$ 46.367	$ 47.654
Modernization & Service/Repairs	45.217	46.470

OVERTIME PAY
Constructor See (D, M, T) on OVERTIME PAGE.

Modern/Service See (B, F, S) on OVERTIME PAGE.

HOLIDAY
Paid: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
WAGES PER HOUR:

6 MONTH TERMS:

1st Term*	2nd & 3rd Term*	4th & 5th Term	6th & 7th Term	8th & 9th Term
50%	50%	55%	65%	75%

* Note: 1st, 2nd, 3rd Terms are based on Average of the Constructor, the Modernization and the Service/Repair wage.
Terms 4 thru 9 Based on Journeyman's wage of classification Working in.

SUPPLEMENTAL BENEFITS:

	07/01/2024	03/17/2025
Elevator Constructor		
1st Term	$ 0.00	$ 0.00
2nd & 3rd Term	36.15	36.90
4th & 5th Term	37.19	37.99
6th & 7th Term	38.80	39.70
8th & 9th Term	40.41	41.40
Modernization & Service/Repair		
1st Term	$ 0.00	$ 0.00
2nd & 3rd Term	36.15	36.90
4th & 5th Term	37.19	37.99
6th & 7th Term	38.80	39.70

8th & 9th Term	40.41	41.40

4-1

Elevator Constructor — 03/01/2025

JOB DESCRIPTION Elevator Constructor **DISTRICT** 1

ENTIRE COUNTIES
Columbia, Dutchess, Greene, Orange, Putnam, Sullivan, Ulster

PARTIAL COUNTIES
Delaware: Towns of Andes, Bovina, Colchester, Davenport, Delhi, Harpersfield, Hemdon, Kortright, Meredith, Middletown, Roxbury, Hancock & Stamford
Rockland: Only the Township of Stony Point.
Westchester: Only the Townships of Bedford, Lewisboro, Cortland, Mt. Kisco, North Salem, Pound Ridge, Somers and Yorktown.

WAGES

Per Hour	07/01/2024	01/01/2025
Mechanic	$ 70.15	$ 73.07
Helper	70% of Mechanic Wage Rate	70% of Mechanic Wage Rate

SUPPLEMENTAL BENEFITS
Per hour

	07/01/2024	01/01/2025
Journeyworker/Helper	$ 37.885*	$ 38.435*

(*)Plus 6% of regular hourly if less than 5 years of service. Plus 8% of regular hourly rate if more than 5 years of service.

OVERTIME PAY
See (D, O) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 15, 16) on HOLIDAY PAGE
Overtime: See (5, 6, 15, 16) on HOLIDAY PAGE
Note: When a paid holiday falls on Saturday, it shall be observed on Friday. When a paid holiday falls on Sunday, it shall be observed on Monday.

REGISTERED APPRENTICES
Wages per hour:

0-6 mo*	6-12 mo	2nd yr	3rd yr	4th yr
50 %	55 %	65 %	70 %	80 %

(*)Plus 6% of the hourly rate, no additional supplemental benefits.

Supplemental Benefits per hour worked:

Same as Journeyperson/Helper

1-138

Glazier — 03/01/2025

JOB DESCRIPTION Glazier **DISTRICT** 8

ENTIRE COUNTIES
Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

WAGES
Per hour:

	07/01/2024	05/01/2025 Additional
Glazier, Glass Tinting and Window Film	$ 63.28	$ 1.11***
Scaffolding, including swing scaffold	67.28	
*Mechanical Equipment	64.28	
**Repair & Maintenance	30.76	

*Mechanical equipment, scissor jacks, man lifts, booms & buckets 30' or more, but not pipe scaffolding.
**Repair & Maintenance- All repair & maintenance work on a particular building whenever performed, where the total cumulative Repair & Maintenance contract value is under $193,000.

***To be allocated at a later date.

SUPPLEMENTAL BENEFITS

Per hour:	7/01/2024
Glazier, Glass Tinting Window Film, Scaffolding and Mechanical Equipment	$ 42.13
Repair & Maintenance	24.62

OVERTIME PAY
See (B, E, Q, V) on OVERTIME PAGE
For 'Repair & Maintenance' see (B, B2, I, S) on overtime page.

HOLIDAY
Paid: See (5, 6, 16, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE
For 'Repair & Maintenance'
Paid: See(5, 6, 16, 25)
Overtime: See(5, 6, 16, 25)

REGISTERED APPRENTICES
Wage per hour:
(1) year terms at the following wage rates:

	7/01/2024
1st term	$ 22.34
2nd term	30.64
3rd term	40.87
4th term	50.14

Supplemental Benefits:
(Per hour)

1st term	$ 19.27
2nd term	27.34
3rd term	32.85
4th term	36.01

8-1087 (DC9 NYC)

Insulator - Heat & Frost — 03/01/2025

JOB DESCRIPTION Insulator - Heat & Frost **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per Hour:	07/01/2024
Insulators Heat & Frost	$ 71.01

SUPPLEMENTAL BENEFITS

Per Hour:	
Insulators Heat & Frost	$ 36.76

OVERTIME PAY
See (B, E, *Q, V) on OVERTIME PAGE
* Triple time for Labor Day (If worked)

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages:
1 year terms.
Wages Per Hour:

1st	2nd	3rd	4th
$ 31.96	$ 39.06	$ 46.16	$ 53.26

Supplemental Benefits:

$ 16.56	$ 20.23	$ 23.91	$ 27.06

4-12

Insulator - Heat & Frost — 03/01/2025

JOB DESCRIPTION Insulator - Heat & Frost **DISTRICT** 8

ENTIRE COUNTIES
Dutchess, Orange, Putnam, Rockland, Westchester

WAGES

Per hour:	07/01/2024
Insulator	$ 60.85
Discomfort & Additional Training**	63.92
Fire Stop Work*	32.97

* Applies on all exclusive Fire Stop Work (When contract is for Fire Stop work only). No apprentices on these contracts only.

**Applies to work requiring; garb or equipment worn against the body not customarily worn by insulators; psychological evaluation ;special training, including but not limited to "Yellow Badge" radiation training

Note: Additional $0.50 per hour for work 30 feet or more above floor or ground level.

SUPPLEMENTAL BENEFITS

Per hour:	
Journeyworker	$ 38.25
Discomfort & Additional Training	40.32
Fire Stop Work:	
Journeyworker	19.48

OVERTIME PAY
See (B, E, E2, Q, *T) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Note: Last working day preceding Christmas and New Years day, workers shall work no later than 12:00 noon and shall receive 8 hrs pay.

Overtime: See (2*, 4, 6, 16, 25) on HOLIDAY PAGE.
*Note: Labor Day triple time if worked.

REGISTERED APPRENTICES
(1) year terms:

Insulator Apprentices:

1st	2nd	3rd	4th
$ 32.97	$ 38.54	$ 44.12	$ 49.70

Discomfort & Additional Training Apprentices:

1st	2nd	3rd	4th
$ 34.51	$ 40.38	$ 46.27	$ 52.16

Supplemental Benefits paid per hour:

Insulator Apprentices:	
1st term	$ 19.48
2nd term	23.23
3rd term	26.98
4th term	30.74

Discomfort & Additional Training Apprentices:	
1st term	$ 20.50
2nd term	24.47

3rd term	28.43
4th term	32.39

8-91

Ironworker **03/01/2025**

JOB DESCRIPTION Ironworker **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per Hour:	07/01/2024	01/01/2025 Additional
Stone Derrickmen Rigger	$ 75.40	$ 1.64*
Stone Handset Derrickman	72.55	1.11*

*To be allocated at a later date.

SUPPLEMENTAL BENEFITS
Per hour:

Stone Derrickmen Rigger	$ 45.52
Stone Handset Derrickman	44.76

OVERTIME PAY
See (B, D1, *E, Q, **V) on OVERTIME PAGE
*Time and one-half shall be paid for all work on Saturday up to eight (8) hours and double time shall be paid for all work thereafter.
** Benefits same premium as wages on Holidays only

HOLIDAY
Paid: See (18) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 25) on HOLIDAY PAGE
Work stops at schedule lunch break with full day's pay.

REGISTERED APPRENTICES
Wage per hour:

Stone Derrickmen Rigger:

	1st	2nd	3rd	4th
07/01/2024	$ 37.20	$ 53.28	$ 59.32	$ 65.36

Supplemental Benefits:
Per hour:

07/01/2024	23.27	34.39	34.39	34.39

Stone Handset:

1/2 year terms at the following hourly wage rate:

	1st	2nd	3rd	4th
07/01/2024	$ 35.78	$ 51.04	$ 56.79	$ 62.55

Supplemental Benefits:
Per hour:

07/01/2024	22.95	34.08	34.08	34.08

9-197D/R

Ironworker **03/01/2025**

JOB DESCRIPTION Ironworker **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per Hour:	07/01/2024	01/01/2025
Ornamental	$ 47.65	$ 47.90
Chain Link Fence	47.65	47.90

Guide Rail	47.65	47.90

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker:	$ 66.29	$ 67.29

OVERTIME PAY
See (B, B1, Q, V) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
1 year terms

1st Term	$ 25.98	$ 26.45
2nd Term	28.45	28.97
3rd Term	30.80	31.36
4th Term	34.39	35.02

Supplemental Benefits per hour:

1st Term	$ 16.29	$ 16.29
2nd Term	18.29	18.29
3rd Term	19.29	19.29
4th Term	20.29	20.29

4-580-Or

Ironworker **03/01/2025**

JOB DESCRIPTION Ironworker **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES
PER HOUR:

	07/01/2024	01/01/2025
Ironworker:		
Structural	$ 57.20	$ 58.45
Bridges		
Machinery		

SUPPLEMENTAL BENEFITS
PER HOUR PAID:

Journeyman	$ 89.85	$ 91.35

OVERTIME PAY
See (B, B1, Q, *V) on OVERTIME PAGE
*NOTE: Benefits are calculated for every hour paid.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 18, 19) on HOLIDAY PAGE

REGISTERED APPRENTICES
WAGES PER HOUR:

6 month terms at the following rate:

1st	$ 30.23	$ 30.36
2nd	30.83	30.96
3rd - 6th	31.44	31.57

Supplemental Benefits PER HOUR PAID:	62.47	63.48

4-40/361-Str

Ironworker **03/01/2025**

JOB DESCRIPTION Ironworker **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

PARTIAL COUNTIES
Rockland: Southern section - south of Convent Road and east of Blue Hills Road.

WAGES

Per hour:	07/01/2024
Reinforcing & Metal Lathing	$ 56.95
"Base" Wage	55.20 plus $ 1.75

"Base" Wage is used to calculate overtime hours only.

SUPPLEMENTAL BENEFITS

Per hour:	
Reinforcing & Metal Lathing	$ 44.63

OVERTIME PAY
See (B, E, Q, *X) on OVERTIME PAGE
*Only $23.50 per Hour for non worked hours

Supplemental Benefit Premiums for Overtime Hours worked:

Time & One Half	$ 51.13
Double Time	57.63

HOLIDAY

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (5, 6, 11, 13, *18, **19, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
(1) year terms at the following wage rates:

Prior to 01/01/2020:

1st term	2nd term	3rd term	4th Term
Wage Per Hour:			
$ 22.55	$ 28.38	$ 34.68	$ 37.18
"Base" Wage			
$21.00	$26.80	$33.10	$35.60
plus $1.55	plus $1.58	plus $1.58	plus $1.58

"Base" Wage is used to calculate overtime hours ONLY.

SUPPLEMENTAL BENIFITS
Per Hour:

1st term	2nd term	3rd term	4th Term
$18.17	$21.34	$22.00	$22.50

After 01/01/2020:

1st term	2nd term	3rd term	4th Term
Wage Per Hour:			
$ 22.55	$ 23.60	$ 24.60	$ 25.65
"Base" Wage			
$21.00	$22.00	$23.00	$24.00
plus $1.55	plus $1.60	plus $1.60	plus $1.65

"Base" Wage is used to calculate overtime hours ONLY.

SUPPLEMENTAL BENIFITS
Per Hour:

1st term	2nd term	3rd term	4th Term
$18.40	$17.40	$16.45	$15.45

4-46Reinf

JOB DESCRIPTION Laborer - Building **DISTRICT** 8

ENTIRE COUNTIES
Putnam, Westchester

WAGES

Per hour	07/01/2024
Laborer	$ 37.95 plus $5.45**
Laborer/Asbestos & Hazardous Materials Removal	$ 39.60* plus $5.45**

* Abatement/Removal of:
- Lead based or lead containing paint on materials to be repainted is classified as Painter.
- Asbestos containing roofs and roofing material is classified as Roofer.

** This portion is not subject to overtime premium.

NOTE: Upgrade/Material condition work plan for work performed during non-outage under a wage formula of 90% wage/100% fringe benefits at nuclear power plants.

SUPPLEMENTAL BENEFITS

Per hour:	07/01/2024
Journeyworker	$ 31.95

OVERTIME PAY
See (B, E, E2, Q, *V) on OVERTIME PAGE
*Note: For Sundays and Holidays worked benefits are at the same premium as wages.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
LABORER ONLY
Hourly terms at the following wage:

Level A	Level B	Level C	Level D
0-1000	1001-2000	2001-3000	3001-4000
$ 28.08	$ 31.90	$ 35.72	$ 39.54

Supplemental Benefits per hour:

Apprentices	
All terms	$ 23.60

8-235/B

Laborer - Heavy&Highway **03/01/2025**

JOB DESCRIPTION Laborer - Heavy&Highway **DISTRICT** 8

ENTIRE COUNTIES
Putnam, Westchester

WAGES
PUTNAM: APPLIES TO ALL HEAVY & HIGHWAY WORK EXCLUDING HIGHWAYS, STREETS, AND BRIDGES

GROUP I: Blaster, Quarry Master, Curbs/Asphalt Screedman, Pipe Jacking and Boring Operations Operator, Qualified Dead Condition Pipe Fuser (B Mechanic)

GROUP II: Burner, Drillers(jumbo, joy, wagon, air track, hydraulic), Drill Operator, Self Contained Rotary Drill, Curbs, Raker, Bar Person, Concrete Finisher.

GROUP III: Pavement Breakers, Jeeper Operator, Jack Hammer, Pneumatic Tools (all), Gas Driller, Guniting, Railroad Spike Puller, Pipelayer, Chain Saw, Deck winches on scows, Power Buggy Operator, Power Wheelbarrow Operator, Bar Person Helper, Compressed Airlance, Water Jet Lance.

GROUP IV: Concrete Laborers, Asph. Worker, Rock Scaler, Vibrator Oper., Bit Grinder, Air Tamper, Pumps, Epoxy (adhesives, fillers and troweled on), Barco Rammer, Concrete Grinder, Crack Router Operator, Guide Rail-digging holes and placing concrete and demolition when not to be replaced, distribution of materials and tightening of bolts.

GROUP V: Drillers Helpers, Common Laborer, Mason Tenders, Signal Person, Pit Person, Truck Spotter, Powder Person, Landscape/Nursery Person, Dump Person, Temp. Heat.

GROUP VIA: Asbestos/Toxic Waste Laborer-All removal (Roads, Tunnels, Landfills, etc.) Confined space laborer, Bio-remediation, Phyto-remediation, Lead or Hazardous material, Abatement Laborer.

Wages:(per hour)	07/01/2024
GROUP I	$ 50.62*
GROUP II	49.27*
GROUP III	48.87*
GROUP IV	48.52*
GROUP V	48.17*
GROUP VIA	50.17*
Operator Qualified	
Gas Mechanic(A Mech)	60.62*
Flagperson	41.82*

*NOTE: To calculate overtime premiums, deduct $0.10 from above wages

SHIFT WORK
A shift premium will be paid on Public Work contracts for off-shift or irregular shift work when mandated by the NYS D.O.T. or other Governmental Agency contracts. Employees shall receive an additional 15% per hour above current rate for all regular and irregular shift work. Premium pay shall be calculated using the 15% per hour differential as base rate.

SUPPLEMENTAL BENEFITS
Per hour:
Journeyworker:
First 40 Hours
Per Hour $ 27.78
Over 40 Hours
Per Hour 21.03

OVERTIME PAY
See (B, E, P, R, S) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 8, 15, 25, 26) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 15, 25, 26) on HOLIDAY PAGE
NOTE: For Holiday Overtime: 5, 6 - Code 'S' applies
For Holiday Overtime: 8, 15, 25, 26 - Code 'R' applies

REGISTERED APPRENTICES

	1st term	2nd term	3rd term	4th term
	1-1000hrs	1001-2000hrs	2001-3000hrs	3001-4000hrs
07/01/2024	$ 28.07	$ 33.12	$ 37.94	$ 42.76

Supplemental Benefits per hour:

1st term	$ 3.85 - After 40 hours: $ 3.50
2nd term	$ 3.95 - After 40 hours: 3.50
3rd term	$ 4.45 - After 40 hours: 3.90
4th term	$ 5.00 - After 40 hours: 4.40

8-60H/H

Laborer - Tunnel 03/01/2025

JOB DESCRIPTION Laborer - Tunnel **DISTRICT** 11

ENTIRE COUNTIES
Columbia, Dutchess, Greene, Orange, Otsego, Putnam, Rockland, Sullivan, Ulster, Westchester

PARTIAL COUNTIES
Chenango: Townships of Columbus, Sherburne and New Berlin.
Delaware: Townships of Andes, Bovina, Middletown, Roxbury, Franklin, Hamden, Stamford, Delhi, Kortright, Harpersfield, Merideth and Davenport.

WAGES
Class 1: All support laborers/sandhogs working above the shaft or tunnel.

Class 2: All laborers/sandhogs working in the shaft or tunnel.

Class 4: Safety Miners

Class 5: Site work related to Shaft/Tunnel

WAGES: (per hour)

	07/01/2024	06/01/2025
Class 1	$ 57.05	$ 58.55
Class 2	59.20	60.70
Class 4	65.60	67.10
Class 5	49.90	51.40

Toxic and hazardous waste, lead abatement and asbestos abatement work will be paid an additional $ 3.00 an hour.

SHIFT WORK

SHIFT DIFFERENTIAL...On all Government mandated irregular shift work:

- Employee shall be paid at time and one half the regular rate Monday through Friday.
- Saturday shall be paid at 1.65 times the regular rate.
- Sunday shall be paid at 2.15 times the regular rate.

SUPPLEMENTAL BENEFITS

Per hour:

Benefit 1	$ 36.98	$ 38.23
Benefit 2	55.39	59.99
Benefit 3	74.58	76.73

Benefit 1 applies to straight time hours, paid holidays not worked.
Benefit 2 applies to over 8 hours in a day (M-F), irregular shift work hours worked, and Saturday hours worked.
Benefit 3 applies to Sunday and Holiday hours worked.

OVERTIME PAY

See (B, E, Q, X) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 15, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 15, 16, 25) on HOLIDAY PAGE

When a recognized Holidays falls on Saturday or Sunday, holidays falling on Saturday shall be recognized or observed on Friday and holidays falling on Sunday shall be recognized or observed on Monday. Employees ordered to work on the Saturday or Sunday of the holiday or on the recognized or the observed Friday or Monday for those holidays falling on Saturday or Sunday shall receive double time the established rate and benefits for the holiday.

REGISTERED APPRENTICES

FOR APPRENTICE RATES, refer to the appropriate Laborer Heavy & Highway wage rate contained in the wage schedule for the County and location where the work is to be performed.

11-17/60/235/754Tun

Lineman Electrician — 03/01/2025

JOB DESCRIPTION Lineman Electrician **DISTRICT** 6

ENTIRE COUNTIES

Westchester

WAGES

A Lineman/Technician shall perform all overhead aerial work. A Lineman/Technician on the ground will install all electrical panels, connect all grounds, install and connect all electrical conductors, assembly of all electrical materials, conduit, pipe or raceway; placing of fish wire; pulling of cables, wires or fiber optic cable through such raceways; splicing of conductors; dismantling of such structures, lines or equipment.

Crane Operators: Operation of any type of crane on line projects.
Crawler Backhoe: Operation of tracked excavator/crawler backhoe with 1/2 yard bucket or larger on line projects.
Digging Machine Operator: All other digging equipment and augering on line projects.

A Groundman/Truck Driver shall: Build and set concrete forms, handle steel mesh, set footer cages, transport concrete in a wheelbarrow, hand or machine concrete vibrator, finish concrete footers, mix mortar, grout pole bases, cover and maintain footers while curing in cold weather, operate jack hammer, operate hand pavement breaker, tamper, concrete and other motorized saws, as a drill helper, operate and maintain generators, water pumps, chainsaws, sand blasting, operate mulching and seeding machine, air tools, electric tools, gas tools, load and unload materials, hand shovel and/or broom, prepare and pour mastic and other fillers, assist digger operator equipment/operator in ground excavation and restoration, landscape work and painting. Only when assisting a lineman technician, a groundman/truck driver may assist in installing conduit, pipe, cables and equipment.

NOTE: Includes Teledata Work within ten (10) feet of High Voltage Transmission Lines. Also includes digging of holes for poles, anchors, footer, and foundations for electrical equipment.

Below rates apply to electrical overhead and underground distribution and maintenance work and overhead and underground transmission line work, electrical substations, switching structures, continuous pipe-type underground fluid or gas filled transmission conduit and cable installations, maintenance jobs or projects, railroad catenary installations and maintenance, third rail installations, the bonding of rails and the installation of fiber optic cable. Includes access matting for line work.

Per hour:	07/01/2024
Group A:	
Lineman, Tech, Welder	$ 61.91
Crane, Crawler Backhoe	61.91
Cable Splicer-Pipe Type	68.10
Cert. Welder-Pipe Type	65.01
Group B:	
Digging Mach Operator	55.72
Tractor Trailer Driver	52.62
Groundman, Truck Driver	49.53
Equipment Mechanic	49.53
Flagman	37.15

Additional $1.00 per hour for entire crew when a helicopter is used.

SHIFT WORK

THE FOLLOWING RATES WILL APPLY ON ALL CONTRACTING AGENCY MANDATED MULTIPLE SHIFTS OF AT LEAST FIVE (5) DAYS DURATION WORKED BETWEEN THE HOURS LISTED BELOW:

1ST SHIFT	8:00 AM TO 4:30 PM REGULAR RATE
2ND SHIFT	4:30 PM TO 1:00 AM REGULAR RATE PLUS 17.3%
3RD SHIFT	12:30 AM TO 9:00 AM REGULAR RATE PLUS 31.4%

SUPPLEMENTAL BENEFITS

Per hour worked (but also required on non-worked holidays):

	07/01/2024
Group A	$ 30.90 *plus 7% of the hourly wage paid
Group B	$ 26.90 *plus 7% of the hourly wage paid

*The 7% is based on the hourly wage paid, straight time or premium time.

OVERTIME PAY

See (B, E, Q, X) on OVERTIME PAGE. NOTE: Double time for emergency work designated by the Dept. of Jurisdiction.
WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked. Contractor is still responsible to pay the hourly benefit amount for each hour worked.

HOLIDAY

Paid	See (5, 6, 8, 13, 25) on HOLIDAY PAGE plus Governor of NYS Election Day.
Overtime	See (5, 6, 8, 13, 25) on HOLIDAY PAGE plus Governor of NYS Election Day.

NOTE: All paid holidays falling on Saturday shall be observed on the preceding Friday. All paid holidays falling on Sunday shall be observed on the following Monday. Supplements for holidays paid at straight time.

REGISTERED APPRENTICES

WAGES per hour: 1000 hour terms at the following percentage of the applicable Journeyworker's Lineman wage.

1st	2nd	3rd	4th	5th	6th	7th
60%	65%	70%	75%	80%	85%	90%

SUPPLEMENTAL BENEFITS per hour:

	07/01/2024

	$ 26.90 *plus 7% of the hourly wage paid

*The 7% is based on the hourly wage paid, straight time or premium time.

6-1249aWest

Lineman Electrician - Teledata — 03/01/2025

JOB DESCRIPTION Lineman Electrician - Teledata **DISTRICT** 6

ENTIRE COUNTIES
Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Rensselaer, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES
Per hour:

For outside work, stopping at first point of attachment (demarcation).

	07/01/2024	01/01/2025
Cable Splicer	$ 39.24	$ 40.81
Installer, Repairman	$ 37.24	$ 38.73
Teledata Lineman	$ 37.24	$ 38.73
Tech., Equip. Operator	$ 37.24	$ 38.73
Groundman	$ 19.74	$ 20.53

NOTE: EXCLUDES Teledata work within ten (10) feet of High Voltage (600 volts and over) transmission lines. For this work please see LINEMAN.

SHIFT WORK
THE FOLLOWING RATES APPLY WHEN THE CONTRACTING AGENCY MANDATES MULTIPLE SHIFTS OF AT LEAST FIVE (5) DAYS DURATION ARE WORKED. WHEN TWO (2) OR THREE (3) SHIFTS ARE WORKED THE FOLLOWING RATES APPLY:

1ST SHIFT	REGULAR RATE
2ND SHIFT	REGULAR RATE PLUS 10%
3RD SHIFT	REGULAR RATE PLUS 15%

SUPPLEMENTAL BENEFITS

Per hour:	07/01/2024	01/01/2025
Journeyworker	$ 5.70 *plus 3% of the hour wage paid	$ 5.70 *plus 3% of the hour wage paid

*The 3% is based on the hourly wage paid, straight time rate or premium rate.

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE
WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked. Contractor is still responsible to pay the hourly benefit amount for each hour worked.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 16) on HOLIDAY PAGE

6-1249LT - Teledata

Lineman Electrician - Traffic Signal, Lighting — 03/01/2025

JOB DESCRIPTION Lineman Electrician - Traffic Signal, Lighting **DISTRICT** 6

ENTIRE COUNTIES
Westchester

WAGES
Lineman/Technician shall perform all overhead aerial work. A Lineman/Technician on the ground will install all electrical panels, connect all grounds, install and connect all electrical conductors which includes, but is not limited to road loop wires; conduit and plastic or other type pipes that carry conductors, flex cables and connectors, and to oversee the encasement or burial of such conduits or pipes.

Crane Operators: Operation of any type of crane on Traffic Signal/Lighting projects.
Crawler Backhoe: Operation of tracked excavator/crawler backhoe with 1/2 yard bucket or larger on Traffic Signal/Lighting projects.
Digging Machine Operator: All other digging equipment and augering on Traffic Signal/Lighting projects.

A Groundman/Groundman Truck Driver shall: Build and set concrete forms, handle steel mesh, set footer cages, transport concrete in a wheelbarrow, hand or machine concrete vibrator, finish concrete footers, mix mortar, grout pole bases, cover and maintain footers while curing in cold weather, operate jack hammer, operate hand pavement breaker, tamper, concrete and other motorized saws, as a drill helper, operate and maintain generators, water pumps, chainsaws, sand blasting, operate mulching and seeding machine, air tools, electric tools, gas tools, load and unload materials, hand shovel and/or broom, prepare and pour mastic and other fillers, assist digger operator/equipment operator in ground excavation and restoration, landscape work and painting. Only when assisting a lineman technician, a groundman/truck driver may assist in installing conduit, pipe, cables and equipment.

A flagger's duties shall consist of traffic control only.

Per hour:	07/01/2024
Group A:	
Lineman, Technician	$ 55.95
Crane, Crawler Backhoe	55.95
Certified Welder	58.75
Group B:	
Digging Machine	50.36
Tractor Trailer Driver	47.56
Groundman, Truck Driver	44.76
Equipment Mechanic	44.76
Flagman	33.57

Above rates are applicable for installation, testing, operation, maintenance and repair on all Traffic Control (Signal) and Illumination (Lighting) projects, Traffic Monitoring Systems, and Road Weather Information Systems. Includes digging of holes for poles, anchors, footer foundations for electrical equipment; assembly of all electrical materials or raceway; placing of fish wire; pulling of cables, wires or fiber optic cable through such raceways; splicing of conductors; dismantling of such structures, lines or equipment.

SHIFT WORK
THE FOLLOWING RATES WILL APPLY ON ALL CONTRACTING AGENCY MANDATED MULTIPLE SHIFTS OF AT LEAST FIVE (5) DAYS DURATION WORKED BETWEEN THE HOURS LISTED BELOW:

1ST SHIFT	8:00 AM TO 4:30 PM REGULAR RATE
2ND SHIFT	4:30 PM TO 1:00 AM REGULAR RATE PLUS 17.3%
3RD SHIFT	12:30 AM TO 9:00 AM REGULAR RATE PLUS 31.4%

SUPPLEMENTAL BENEFITS
Per hour worked:

	07/01/2024
Group A	$ 30.90 *plus 7% of the hourly wage paid
Group B	$ 26.90 *plus 7% of the hourly wage paid

*The 7% is based on the hourly wage paid, straight time or premium time.

OVERTIME PAY
See (B, E, Q, X) on OVERTIME PAGE. *Note* Double time for emergency work designated by the Dept. of Jurisdiction.
WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked. Contractor is still responsible to pay the hourly benefit amount for each hour worked.

HOLIDAY
Paid: See (5, 6, 8, 13, 25) on HOLIDAY PAGE and Governor of NYS Election Day.
Overtime: See (5, 6, 8, 13, 25) on HOLIDAY PAGE and Governor of NYS Election Day.

NOTE: All paid holidays falling on Saturday shall be observed on the preceding Friday. All paid holidays falling on Sunday shall be observed on the following Monday. Supplements for holidays paid at straight time.

REGISTERED APPRENTICES
WAGES per hour: 1000 hour terms at the following percentage of the applicable Journeyworker's Lineman wage.

1st	2nd	3rd	4th	5th	6th	7th
60%	65%	70%	75%	80%	85%	90%

SUPPLEMENTAL BENEFITS per hour:

07/01/2024
$ 26.90 *plus 7% of the hourly wage paid

*The 7% is based on the hourly wage paid, straight time or premium time.

6-1249aWestLT

Mason - Building — 03/01/2025

JOB DESCRIPTION Mason - Building **DISTRICT** 9

ENTIRE COUNTIES
Nassau, Rockland, Suffolk, Westchester

WAGES

Per hour:	07/01/2024	12/02/2024
Tile Setters	$ 63.91	$ 64.16

SUPPLEMENTAL BENEFITS
Per Hour:

	$ 27.66* +8.50	$ 28.11* +8.51

* This portion of benefits subject to same premium rate as shown for overtime wages.

OVERTIME PAY
See (B, E, Q, V) on OVERTIME PAGE
Work beyond 10 hours on Saturday shall be paid at double the hourly wage rate.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wage per hour:

(750 hour) term at the following wage rate:
Term:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1-750	751-1500	1501-2250	2251-3000	3001-3750	3751-4500	4501-5250	5251-6000	6001-6750	6501-7000
07/01/2024									
$22.19	$27.21	$34.45	$39.46	$43.07	$46.58	$50.23	$55.24	$57.71	$62.00
12/02/24									
$22.29	$27.35	$34.36	$39.41	$43.05	$46.60	$50.29	$55.33	$57.84	$62.20

Supplemental Benefits per hour:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
07/01/2024									
$12.55* +$.76	$12.55* +$.81	$15.36* +$.91	$15.36* +$.96	$16.36* +$1.43	$17.86* +$1.48	$18.86* +$1.91	$18.86* +$1.97	$18.86* +$4.57	$24.11* +$5.18
12/02/24									
$12.70* +$.76	$12.70* +$.81	$15.81* +$.91	$15.81* +$.96	$16.81* +$1.43	$18.31* +$1.48	$19.31* +$1.91	$19.31* +$1.97	$19.31* +$4.57	$24.56* +$5.18

* This portion of benefits subject to same premium rate as shown for overtime wages.

9-7/52A

Mason - Building 03/01/2025

JOB DESCRIPTION Mason - Building **DISTRICT** 11

ENTIRE COUNTIES
Putnam, Rockland, Westchester

PARTIAL COUNTIES
Orange: Only the Township of Tuxedo.

WAGES
Per hour:

	07/01/2024
Bricklayer	$ 47.44
Cement Mason	47.44
Plasterer/Stone Mason	47.44
Pointer/Caulker	47.44

Additional $1.00 per hour for power saw work
Additional $0.50 per hour for swing scaffold or staging work

SHIFT WORK
SHIFT WORK: When shift work or an irregular workday is mandated or required by state, federal, county, local or other governmental agency contracts, the following premiums apply:

Irregular workday requires 15% premium
Second shift an additional 15% of wage plus benefits to be paid
Third shift an additional 25% of wage plus benefits to be paid

SUPPLEMENTAL BENEFITS
Per hour:

Journeyman	$ 38.50

OVERTIME PAY
OVERTIME:

Cement Mason	See (B, E, Q, W) on OVERTIME PAGE.
All Others	See (B, E, Q) on OVERTIME PAGE.

HOLIDAY

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (5, 6, 16, 25) on HOLIDAY PAGE

Whenever any of the above holidays fall on Sunday, they will be observed on Monday. Whenever any of the above holidays fall on Saturday, they will be observed on Friday.

REGISTERED APPRENTICES
Wages per hour:

750 hour terms at the following percentage of Journeyman's wage

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Supplemental Benefits per hour

750 hour terms at the following percentage of journeyman supplements

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Apprentices indentured before June 1st, 2011 receive full journeyman benefits

11-5wp-b

Mason - Building 03/01/2025

JOB DESCRIPTION Mason - Building **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES
Building

	07/01/2024	01/01/2025

Wages per hour:

Mosaic & Terrazzo Mechanic	$ 60.98	$ 61.33
Mosaic & Terrazzo Finisher	58.96	59.72

SUPPLEMENTAL BENEFITS
Per hour:

Mosaic & Terrazzo Mechanic	$ 31.36* + $9.78	$ 31.46* + $10.39
Mosaic & Terrazzo Finisher	$ 31.36* + $9.77	$ 31.46* + $10.38

*This portion of benefits subject to same premium rate as shown for overtime wages.

OVERTIME PAY
See (A, E, Q) on OVERTIME PAGE
07/01/2024- Deduct $7.00 from hourly wages before calculating overtime.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE
Easter Sunday is an observed holiday.Holidays falling on a Saturday will be observed on that Saturday. Holidays falling on a Sunday will be celebrated on the Monday.

REGISTERED APPRENTICES
Wages Per hour:

	1st 0-1500	2nd 1501-3000	3rd 3001-3750	4th 3751-4500	5th 4501-5250	6th 5251-6000
07/01/2024	$ 25.19	$ 32.39	$ 38.18	$ 40.78	$ 49.00	$ 55.75
01/01/2025	25.36	32.60	39.95	41.09	49.37	56.15

Supplemental Benefits per hour:

07/01/2024	$7.12* + 3.43	$9.16* + 4.40	$17.22* + 5.87	$23.86* + 6.84	$24.86* + 7.83	$27.36* + 8.80
01/01/2025	$7.12* + 3.64	$9.16* + 4.67	$15.72* + 6.24	$23.86* + 7.27	$24.86* + 8.31	$27.36* + 9.35

*This portion of benefits subject to same premium rate as shown for overtime wages.

9-7/3

Mason - Building — 03/01/2025

JOB DESCRIPTION Mason - Building **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per hour:	07/01/2024	01/06/2025
Building-Marble Restoration:		
Marble, Stone & Terrazzo Polisher	$ 47.72	$ 47.93

SUPPLEMENTAL BENEFITS
Per Hour:
Journeyworker:

Building-Marble Restoration:		
Marble, Stone & Polisher	$ 31.50	$ 31.86

OVERTIME PAY
See (B, *E, Q, V) on OVERTIME PAGE
* On Saturdays, 8th hour and successive hours paid at double hourly rate.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 11, 15, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
WAGES per hour:

900 hour term at the following wage:

	1st 1-900	2nd 901-1800	3rd 1801-2700	4th 2701
07/01/2024	$ 33.40	$ 38.18	$ 42.94	$ 47.72
01/06/2025	33.54	38.34	43.13	47.93
Supplemental Benefits Per Hour:				
07/01/2024	29.06	29.87	30.69	31.50
01/06/2025	29.59	30.34	31.11	31.86

9-7/24-MP

Mason - Building **03/01/2025**

JOB DESCRIPTION Mason - Building **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

WAGES
Per Hour:

	07/01/2024	01/06/2025
Marble Cutters & Setters	$ 63.92	$ 64.21

SUPPLEMENTAL BENEFITS
Per Hour:

Journeyworker	$ 40.05	$ 40.51

OVERTIME PAY
See (B, E, Q, V) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wage Per Hour:

750 hour terms at the following wage

1st	2nd	3rd	4th	5th	6th	7th	8th
0-3000	3001-3750	3751-4500	4501-5250	5251-6000	6001-6750	6751-7500	7500+
07/01/2024							
$ 27.01	$ 40.52	$ 43.88	$ 47.26	$ 50.64	$ 54.32	$ 60.71	$ 63.92
01/06/2025							
$ 27.24	$ 40.84	$ 44.25	$ 47.63	$ 51.05	$ 54.58	$ 60.99	$ 64.21

Supplemental Benefits per hour:

1st	2nd	3rd	4th	5th	6th	7th	8th
07/01/2024							
$ 26.42	$ 29.76	$ 30.61	$ 31.44	$ 32.28	$ 37.55	$ 39.23	$ 40.05
01/06/2025							
$ 26.88	$ 30.14	$ 30.95	$ 31.78	$32.59	$38.07	$ 39.71	$ 40.51

9-7/4

Mason - Building **03/01/2025**

JOB DESCRIPTION Mason - Building **DISTRICT** 9

ENTIRE COUNTIES

Nassau, Rockland, Suffolk, Westchester

WAGES

Per hour:	07/01/2024	12/02/2024
Tile Finisher	$ 49.08	$ 49.21

*To be allocated at a later date.

SUPPLEMENTAL BENEFITS

Per Hour:

	$ 24.56*	$ 25.01*
	+ 8.32	+ 8.33

*This portion of benefits is subjected to same premium rate as shown for overtime wages

OVERTIME PAY

See (B, E, Q, *V) on OVERTIME PAGE
*Work beyond 10 hours on a Saturday shall be paid at double the hourly wage rate.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 15, 16, 25) on HOLIDAY PAGE

9-7/88A-tf

Mason - Building — 03/01/2025

JOB DESCRIPTION Mason - Building **DISTRICT** 9

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per hour:	07/01/2024	01/06/2025
Marble, Stone, Maintenance Finishers:	$ 27.72	$ 27.99

Note 1: An additional $2.00 per hour for time spent grinding floor using "60 grit" and below.
Note 2: Flaming equipment operator shall be paid an additional $25.00 per day.

SUPPLEMENTAL BENEFITS

Per Hour:

Marble, Stone Maintenance Finishers:	$ 15.74	$ 15.88

OVERTIME PAY

See (B, *E, Q, V) on OVERTIME PAGE
*Double hourly rate after 8 hours on Saturday

HOLIDAY

Paid: See (5, 6, 8, 11, 15, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 15, 25) on HOLIDAY PAGE
1st term apprentice gets paid for all observed holidays.

REGISTERED APPRENTICES

WAGES per hour:

	07/01/2024	01/06/2025
0-750	$ 22.32	$ 22.91
751-1500	23.04	23.59
1501-2250	23.75	24.26
2251-3000	24.48	24.95
3001-3750	25.56	25.96
3751-4500	27.00	27.32
4501+	27.72	27.99

Supplemental Benefits:
Per hour:

0-750	12.69	12.43
751-1500	13.10	12.89

1501-2250	13.51	13.35
2251-3000	13.91	13.80
3001-3750	14.52	14.50
3751-4500	15.33	15.41
4501+	15.74	15.88

9-7/24M-MF

Mason - Building / Heavy&Highway 03/01/2025

JOB DESCRIPTION Mason - Building / Heavy&Highway **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES
Per hour:

	07/01/2024	01/06/2025
Marble-Finisher	$ 49.99	$ 50.22

SUPPLEMENTAL BENEFITS
Journeyworker:
Per hour

Marble- Finisher	$ 37.39	$ 37.69

OVERTIME PAY
See (B, E, Q, V) on OVERTIME PAGE
Work beyond 8 hours on a Saturday shall be paid at double the rate.

HOLIDAY
Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE
When an observed holiday falls on a Sunday, it will be observed the next day.

9-7/20-MF

Mason - Heavy&Highway 03/01/2025

JOB DESCRIPTION Mason - Heavy&Highway **DISTRICT** 11

ENTIRE COUNTIES
Putnam, Rockland, Westchester

PARTIAL COUNTIES
Orange: Only the Township of Tuxedo.

WAGES
Per hour:

	07/01/2024
Bricklayer	$ 47.94
Cement Mason	47.94
Marble/Stone Mason	47.94
Plasterer	47.94
Pointer/Caulker	47.94

Additional $1.00 per hour for power saw work
Additional $0.50 per hour for swing scaffold or staging work

SHIFT WORK
When shift work or an irregular workday is mandated or required by state, federal, county, local or other governmental contracts, the following rates apply:

Irregular workday requires 15% premium
Second shift an additional 15% of wage plus benefits to be paid
Third shift an additional 25% of wage plus benefits to be paid

SUPPLEMENTAL BENEFITS
Per hour:

Journeyman	$ 38.50

OVERTIME PAY

Cement Mason	See (B, E, Q, W)
All Others	See (B, E, Q,)

HOLIDAY

Paid:	See (5, 6, 16, 25) on HOLIDAY PAGE
Overtime:	See (5, 6, 16, 25) on HOLIDAY PAGE

- Whenever any of the above holidays fall on Sunday, they will be observed on Monday. Whenever any of the above holidays fall on Saturday, they will be observed on Friday.
- Supplemental Benefits are not paid for paid Holiday
- If Holiday is worked, Supplemental Benefits are paid for hours worked.
- Whenever an Employee works within three (3) calendar days before a holiday, the Employee shall be paid for the Holiday.

REGISTERED APPRENTICES
Wages per hour:

750 hour terms at the following percentage of Journeyman's wage

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Supplemental Benefits per hour

750 hour terms at the following percentage of journeyman supplements

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Apprentices indentured before June 1st, 2011 receive full journeyman benefits

11-5WP-H/H

Operating Engineer - Building — 03/01/2025

JOB DESCRIPTION Operating Engineer - Building **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Putnam, Queens, Richmond, Westchester

PARTIAL COUNTIES
Dutchess: that part of Dutchess County lying south of the North City Line of the City of Poughkeepsie.

WAGES
NOTE: Construction surveying
Party Chief--One who directs a survey party
Instrument Man--One who runs the instrument and assists Party Chief.
Rodman--One who holds the rod and assists the Survey Crew

Wages:(Per Hour)	07/01/2024
Building Construction:	
Party Chief	$ 79.99
Instrument Man	60.36
Rodman	40.45
Steel Erection:	
Party Chief	83.13
Instrument Man	64.21
Rodman	44.33
Heavy Construction-NYC counties only: (Foundation, Excavation.)	
Party Chief	88.06
Instrument man	65.66
Rodman	55.70

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2024
Building Construction	$ 28.63* +$ 7.65
Steel Erection	29.23* + 7.65
Heavy Construction	30.04* + 7.64

* This portion subject to SAME premium as wages

Non-Worked Holiday Supplemental Benefit:
21.83

OVERTIME PAY
See (A, B, E, Q) on OVERTIME PAGE
Code "A" applies to Building Construction and has double the rate after 7 hours on Saturdays.
Code "B" applies to Heavy Construction and Steel Erection and had double the rate after 8 hours on Saturdays.

HOLIDAY
Paid: See (5, 6, 9, 11, 15, 16, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 9, 11, 15, 16, 25) on HOLIDAY PAGE

9-15Db

Operating Engineer - Building 03/01/2025

JOB DESCRIPTION Operating Engineer - Building **DISTRICT** 8

ENTIRE COUNTIES
Putnam, Westchester

PARTIAL COUNTIES
Dutchess: All the counties of Westchester and Putnam and the southern part of Dutchess County defined by the northern boundary line of the City of Poughkeepsie, then due east to Route 115, then north along Route 115 to Bedell Road, then east along Bedell Road to Van Wagner Road, then north along Van Wagner Road to Bower Road, then east along Bower Road to Route 44 and along Route 44 east to Route 343, then along Route 343 east to the northern boundary of Town of Dover Plains and east along the northern boundary of Town of Dover Plains to the border line of the State of Connecticut and bordered on the west by the middle of the Hudson River.

WAGES
GROUP I:
Cranes (All Types up to 49 tons), Boom Trucks, Cherry Pickers (All Types), Clamshell Crane, Derrick (Stone and Steel), Dragline, Franki Pile Rig or similar, High Lift (Lull or similar) with crane attachment and winch used for hoisting or lifting, Hydraulic Cranes, Pile Drivers, Potain and similar.

Cranes (All types 50-99 tons), Drill Rig Casa Grande (CAT or similar), Franki Pile Rig or similar, Hydraulic Cranes (All types including Crawler Cranes- No specific boom length).

Cranes (All types 100 tons and over), All Tower Cranes, All Climbing Cranes irrespective of manufacturer and regardless of how the same is rigged, Franki Pile Rig or similar, Conventional Cranes (All types including Crawler Cranes-No specific boom length), Hydraulic Cranes.

GROUP I-A: Barber Green Loader-Euclid Loader, Bulldozer, Carrier-Trailer Horse, Concrete Cleaning Decontamination Machine Operator, Concrete-Portable Hoist, Conway or Similar Mucking Machines, Elevator & Cage, Excavators all types, Front End Loaders, Gradall, Shovel, Backhoe, etc.(Crawler or Truck), Heavy Equipment Robotics Operator/Mechanic, Hoist Engineer-Material, Hoist Portable Mobile Unit, Hoist(Single, Double or Triple Drum), Horizontal Directional Drill Locator, Horizontal Directional Drill Operator and Jersey Spreader, Letourneau or Tournapull(Scrapers over 20 yards Struck), Lift Slab Console, etc., Lull HiLift or Similar, Master Environmental Maintenance Mechanics, Mucking Machines Operator/Mechanic or Similar Type, Overhead Crane, Pavement Breaker(Air Ram), Paver(Concrete), Post Hole Digger, Power House Plant, Road Boring Machine, Road Mix Machine, Ross Carrier and Similar Machines, Rubber tire double end backhoes and similar machines, Scoopmobile Tractor-Shovel Over 1.5 yards, Shovel (Tunnels), Spreader (Asphalt) Telephie(Cableway), Tractor Type Demolition Equipment, Trenching Machines-Vermeer Concrete Saw Trencher and Similar, Ultra High Pressure Waterjet Cutting Tool System, Vacuum Blasting Machine operator/mechanic, Winch Truck A Frame.

GROUP I-B: Compressor (Steel Erection), Mechanic (Outside All Types), Negative Air Machine (Asbestos Removal), Push Button (Buzz Box) Elevator.

GROUP II: Compactor Self-Propelled, Concrete Pump, Crane Operator in Training (Over 100 Tons), Grader, Machines Pulling Sheep's Foot Roller, Roller (4 ton and over), Scrapers (20 yards Struck and Under), Vibratory Rollers, Welder.

GROUP III-A: Asphalt Plant, Concrete Mixing Plants, Forklift (All power sources), Joy Drill or similar, Tractor Drilling Machine, Loader (1 1/2 yards and under), Portable Asphalt Plant, Portable Batch Plant, Portable Crusher, Skid Steer (Bobcat or similar), Stone Crusher, Well Drilling Machine, Well Point System.

GROUP III-B: Compressor Over 125 cu. Feet, Conveyor Belt Machine regardless of size, Compressor Plant, Ladder Hoist, Stud Machine.

GROUP IV-A: Batch Plant, Concrete Breaker, Concrete Spreader, Curb Cutter Machine, Finishing Machine-Concrete, Fine Grading Machine, Hepa Vac Clean Air Machine, Material Hopper(sand, stone, cement), Mulching Grass Spreader, Pump Gypsum etc, Pump-Plaster-Grout-Fireproofing. Roller(Under 4 Ton),Spreading and Fine Grading Machine, Steel Cutting Machine, Siphon Pump, Tar Joint Machine, Television Cameras for Water, Sewer, Gas etc. Turbo Jet Burner or Similar Equipment, Vibrator (1 to 5).

GROUP IV-B: Compressor (all types), Heater (All Types), Fire Watchman, Lighting Unit (Portable & Generator) Pump, Pump Station(Water, Sewer, Portable, Temporary), Welding Machine (Steel Erection & Excavation).

GROUP V: Mechanics Helper, Motorized Roller (walk behind), Stock Attendant, Welder's Helper, Maintenance Engineer Crane(75 ton and over).

Group VI-A: Welder Certified
GROUP VI-B: Utility Man, Warehouse Man.

WAGES: (per hour)

	07/01/2024
GROUP I	
Cranes- up to 49 tons	$ 67.43
Cranes- 50 tons to 99 tons	69.77
Cranes- 100 tons and over	79.64
GROUP I-A	59.04
GROUP I-B	54.41
GROUP II	56.97
GROUP III-A	54.88
GROUP III-B	52.25
GROUP IV-A	54.33
GROUP IV-B	45.94
GROUP V	49.53
Group VI-A	57.96
GROUP VI-B	
Utility Man	47.00
Warehouse Man	49.26

An additional 20% to wage when required to wear protective equipment on hazardous/toxic waste projects.
Engineers operating cranes with booms 100 feet but less than 149 feet in length will be paid an additional $2.00 per hour.
Engineers operating cranes with booms 149 feet or over in length will be paid an additional $3.00 per hour.
Loader operators over 5 cubic yard capacity additional .50 per hour.
Shovel operators over 4 cubic yard capacity additional $1.00 per hour.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 32.32

OVERTIME PAY
See (B, E, Q, V) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 8, 15, 25, 26) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 15, 25, 26) on HOLIDAY PAGE

8-137B

Operating Engineer - Heavy&Highway 03/01/2025

JOB DESCRIPTION Operating Engineer - Heavy&Highway **DISTRICT** 8

ENTIRE COUNTIES
Putnam, Westchester

PARTIAL COUNTIES
Dutchess: All the counties of Westchester and Putnam and the southern part of Dutchess County defined by the northern boundary line of the City of Poughkeepsie, then due east to Route 115, then north along Route 115 to Bedell Road, then east along Bedell Road to Van Wagner Road, then north along Van Wagner Road to Bower Road, then east along Bower Road to Route 44 and along Route 44 east to Route 343, then along Route 343 east to the northern boundary of Town of Dover Plains and east along the northern boundary of Town of Dover Plains to the border line of the State of Connecticut and bordered on the west by the middle of the Hudson River.

WAGES
GROUP I: Boom Truck, Cherry Picker, Clamshell, Crane, (Crawler, Truck),
Dragline, Drill Rig (Casa Grande, Cat, or Similar), Floating Crane (Crane on Barges) under 100 tons, Gin Pole, Hoist Engineer-Concrete (Crane-Derrick-Mine Hoist), Knuckle Boom Crane, Rough Terrain Crane.

GROUP I-A: Auger (Truck or Truck Mounted), Boat Captain, Bulldozer-All Sizes, Central Mix Plant Operator, Chipper (all types), Close Circuit T.V., Combination Loader/Backhoe, Compactor with Blade, Concrete Finishing Machine, Gradall, Grader (Motor Grader), Elevator & Cage (Materials or Passenger), Excavator (and all attachments), Front End Loaders (1 1/2 yards and over), High Lift Lull and similar, Hoist (Single, Double, Triple Drum), Hoist Portable Mobile Unit, Hoist Engineer (Material), Jack and Bore Machine, Log Skidders, Mill Machines, Mucking Machines, Overhead Crane, Paver (concrete), Post Pounder (of any type), Push Cats, Road Reclaimer, Robot Hammer (Brokk or similar), Robotic Equipment (Scope of Engineer Schedule), Ross Carrier and similar, Scrapers (20 yard struck and over), Side Boom, Slip Form Machine, Spreader (Asphalt), Trenching Machines (Telephies-Vermeer Concrete Saw), Tractor Type Demolition Equipment, Vacuum Truck. Vibratory Roller(Riding) or Roller used in mainline paving operations.

GROUP I-B: Asphalt Mobile Conveyor/Transfer Machine, Road Paver (Asphalt).

GROUP II-A: Ballast Regulators, Compactor Self Propelled, Fusion Machine, Rail Anchor Machines, Roller (4 ton and over), Scrapers (20 yard struck and under).

GROUP II-B: Mechanic (Outside) All Types, Shop Mechanic.

GROUP III: Air Tractor Drill, Asphalt Plant, Batch Plant, Boiler (High Pressure), Concrete Breaker (Track or Rubber Tire), Concrete Pump, Concrete Spreader, Excavator Drill, Farm Tractor, Forklift (all types), Gas Tapping (Live), Hydroseeder, Loader (1 1/2 yards and under), Locomotive (all sizes), Machine Pulling Sheeps Foot Roller, Portable Asphalt Plant, Portable Batch Plant, Portable Crusher (Apprentice), Powerhouse Plant, Roller (under 4 ton), Sheer Excavator, Skid Steer/Bobcat, Stone Crusher, Sweeper (with seat), Well Drilling Machine.

GROUP IV: Service Person (Grease Truck), Deckhand.

GROUP IV-B: Conveyor Belt Machine (Truck Mounted), Heater (all types), Lighting Unit (Portable), Maintenance Engineer (For Crane Only), Mechanics Helper, Pump (Fireproofing), Pumps-Pump Station/Water/Sewer/Gypsum/Plaster, etc., Pump Truck (Sewer Jet or Similar), Welders Helper, Welding Machine (Steel Erection), Well Point System.

GROUP V: All Tower Cranes-All Climbing Cranes and all cranes of 100-ton capacity or greater (3900 Manitowac or similar) irrespective of manufacturer and regardless of how the same is rigged, Hoist Engineer (Steel), Engineer-Pile Driver, Jersey Spreader, Pavement Breaker/Post Hole Digger.

WAGES: Per hour:	07/01/2024
Group I	$ 68.63
Group I-A	60.42
Group I-B	63.70
Group II-A	57.84
Group II-B	59.67
Group III	56.81
Group IV	51.57
Group IV-B	44.19
Group V	
Engineer All Tower, Climbing and Cranes of 100 Tons	77.82
Hoist Engineer(Steel)	70.41
Engineer(Pile Driver)	75.13
Jersey Spreader, Pavement Breaker (Air Ram)Post Hole Digger	59.19

Engineers operating cranes with booms 100 feet but less than 149 feet in length will be paid an additional $2.00 per hour over the rate listed in the Wage Schedule. Engineers operating cranes with booms 149 feet or over in length will be paid an additional $3.00 per hour over the rate listed in the Wage Schedule. Loader and Excavator Operators: over 5 cubic yards capacity $0.50 per hour over the rate listed in the Wage Schedule. Shovel Operators: over 4 cubic yards capacity $1.00 per hour over the rate listed in the Wage Schedule.

SHIFT WORK
A 15% premium on all hours paid, including overtime hours for 2nd, 3rd shifts on all government mandated off-shift work

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker:	$ 34.85 up to 40 Hours After 40 hours $ 25.55* PLUS $ 1.25 on all hours worked

*This amount is subject to premium

OVERTIME PAY
See (B, E, P, *R, **U) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 8, 15, 25, 26) on HOLIDAY PAGE
Overtime..... See (5, 6, 8, 15, 25, 26) on OVERTIME PAGE

* For Holiday codes 8,15,25,26 code R applies
** For Holiday Codes 5 & 6 code U applies

Note: If employees are required to work on Easter Sunday they shall be paid at the rate of triple time.

REGISTERED APPRENTICES
(1)year terms at the following rate.

1st term	$ 30.21
2nd term	36.25
3rd term	42.30
4th term	48.34
Supplemental Benefits per hour:	
	26.85

8-137HH

Operating Engineer - Heavy&Highway — 03/01/2025

JOB DESCRIPTION Operating Engineer - Heavy&Highway **DISTRICT** 9

ENTIRE COUNTIES
Putnam, Westchester

PARTIAL COUNTIES
Dutchess: South of the North city line of Poughkeepsie

WAGES
Party Chief - One who directs a survey party
Instrument Man - One who runs the instrument and assists Party Chief
Rodman - One who holds the rod and in general, assists the Survey Crew
Categories cover GPS & Underground Surveying

Per Hour:	07/01/2024
Party Chief	$ 84.94
Instrument Man	63.15
Rodman	53.43

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2024
All Categories	
Straight Time:	$ 30.04* + $7.64
Premium:	
Time & 1/2	$ 45.06* + $7.64
Double Time	$ 60.08* + $7.64

Non-Worked Holiday Supplemental Benefits:
$ 21.83

OVERTIME PAY
See (B, *E, Q) on OVERTIME PAGE
* Doubletime paid on all hours in excess of 8 hours on Saturday

HOLIDAY
Paid: See (5, 6, 7, 11, 12) on HOLIDAY PAGE
Overtime: See (5, 6, 7, 11, 12) on HOLIDAY PAGE

9-15Dh

Operating Engineer - Heavy&Highway - Tunnel — 03/01/2025

JOB DESCRIPTION Operating Engineer - Heavy&Highway - Tunnel **DISTRICT** 8

ENTIRE COUNTIES
Putnam, Westchester

PARTIAL COUNTIES
Dutchess: All the counties of Westchester and Putnam and the southern part of Dutchess County defined by the northern boundary line of the City of Poughkeepsie, then due east to Route 115, then north along Route 115 to Bedell Road, then east along Bedell Road to Van Wagner Road, then north along Van Wagner Road to Bower Road, then east along Bower Road to Route 44 and along Route 44 east to Route 343, then along Route 343 east to the northern boundary of Town of Dover Plains and east along the northern boundary of Town of Dover Plains to the border line of the State of Connecticut and bordered on the west by the middle of the Hudson River.

WAGES

GROUP I: Boom Truck, Cherry Picker, Clamshell, Crane(Crawler, Truck), Dragline, Drill Rig Casa Grande(Cat or Similar), Floating Crane(Crane on Barge-Under 100 Tons), Hoist Engineer(Concrete/Crane-Derrick-Mine Hoist), Knuckle Boom Crane, Rough Terrain Crane.

GROUP I-A: Auger(Truck or Truck Mounted), Boat Captain, Bull Dozer-all sizes, Central Mix Plant Operator, Chipper-all types, Close Circuit T.V., Combination Loader/Backhoe, Compactor with Blade, Concrete Finishing Machine, Gradall, Grader(Motor Grader), Elevator & Cage(Materials or Passengers), Excavator(and all attachments), Front End Loaders(1 1/2 yards and over), High Lift Lull, Hoist(Single, Double, Triple Drum), Hoist Portable Mobile Unit, Hoist Engineer(Material), Jack and Bore Machine, Log Skidder, Milling Machine, Moveable Concrete Barrier Transfer & Transport Vehicle, Mucking Machines. Overhead Crane, Paver(Concrete), Post Pounder of any type, Push Cats, Road Reclaimer, Robot Hammer(Brokk or similar), Robotic Equipment(Scope of Engineer Schedule), Ross Carrier and similar machines, Scrapers(20 yards struck and over), Side Boom, Slip Form Machine, Spreader(Asphalt), Trenching Machines, Telephies-Vermeer Concrete Saw, Tractor type demolition equipment, Vacuum Truck, Vibratory Roller (Riding) used in mainline paving operations.

GROUP I-B: Asphalt Mobile Conveyor/Transfer Machine, Road Paver(Asphalt).

GROUP II-A: Ballast Regulators, Compactor(Self-propelled), Fusion Machine, Rail Anchor Machines, Roller(4 ton and over), Scrapers(20 yard struck and under).

GROUP II-B: Mechanic(outside)all types, Shop Mechanic.

GROUP III: Air Tractor Drill, Asphalt Plant, Batch Plant, Boiler(High Pressure), Concrete Breaker(Track or Rubber Tire), Concrete Pump, Concrete Spreader, Excavator Drill, Farm Tractor, Forklift(all types of power), Gas Tapping(Live), Hydroseeder, Loader(1 1/2 yards and under), Locomotive(all sizes), Machine Pulling Sheeps Foot Roller, Portable Asphalt Plant, Portable Batch Plant, Portable Crusher(Apprentice), Powerhouse Plant, Roller(under 4 ton), Sheer Excavator, Skidsteer/Bobcat, Stone Crusher, Sweeper(with seat), Well Drilling Machine.

GROUP IV-A: Service Person(Grease Truck), Deckhand.

GROUP IV-B: Conveyor Belt Machine(Truck Mounted), Heater(all types), Lighting Unit(Portable), Maintenance Engineer(for Crane only), Mechanics Helper, Pump(Fireproofing), Pumps-Pump Station/Water/Sewer/Gypsum/Plaster, etc., Pump Truck(Sewer Jet or similar), Welding Machine(Steel Erection), Welders Helper.

GROUP V-A: Engineer(all Tower Cranes, all Climbing Cranes & all Cranes of 100 ton capacity or greater),Hoist Engineer(Steel-Sub Structure), Engineer-Pile Driver, Jersey-Spreader, Pavement breaker, Post Hole Digger

WAGES: (per hour)

	07/01/2024
GROUP I	$ 68.63
GROUP I-A	60.42
GROUP I-B	63.70
GROUP II-A	57.84
GROUP II-B	59.67
GROUP III	56.81
GROUP IV-A	51.57
GROUP IV-B	44.19
GROUP V-A	
Engineer-Cranes	77.82
Engineer-Pile Driver	75.13
Hoist Engineer	70.41
Jersey Spreader/Post Hole Digger	59.19

An additional 20% to wage when required to wear protective equipment on hazardous/toxic waste projects. Operators required to use two buckets pouring concrete on other than road pavement shall receive $0.50 per hour over scale. Engineers operating cranes with booms 100 feet but less than 149 feet in length will be paid an additional $2.00 per hour. Engineers operating cranes with booms 149 feet or over in length will be paid an additional $3.00 per hour. Operators of shovels with a capacity over (4) cubic yards shall be paid an additional $1.00 per hour. Operators of loaders with a capacity over (5) cubic yards shall be paid an additional $0.50 per hour.

SHIFT WORK

A 15% premium on all hours paid, including overtime hours for 2nd, 3rd shifts on all government mandated off-shift work

SUPPLEMENTAL BENEFITS

Per hour:
Journeyworker:

$ 34.85 up to 40 hours

After 40 hours
$25.55 plus
$1.25 on all
hours worked

OVERTIME PAY
See (D, O, *U, V) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 8, 15, 25, 26) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 15, 25, 26) on HOLIDAY PAGE
* Note: For Holiday codes 5 & 6, code U applies. For Holiday codes 8, 15, 25, 26, code R applies.
Note: If employees are required to work on Easter Sunday, they shall be paid at the rate of triple time.

REGISTERED APPRENTICES
(1)year terms at the following rates:

1st term	$ 30.21
2nd term	36.25
3rd term	42.30
4th term	48.34

Supplemental Benefits per hour:

All terms	$ 26.85

8-137Tun

Operating Engineer - Marine Dredging 03/01/2025

JOB DESCRIPTION Operating Engineer - Marine Dredging **DISTRICT** 4

ENTIRE COUNTIES
Albany, Bronx, Cayuga, Clinton, Columbia, Dutchess, Essex, Franklin, Greene, Jefferson, Kings, Monroe, Nassau, New York, Orange, Oswego, Putnam, Queens, Rensselaer, Richmond, Rockland, St. Lawrence, Suffolk, Ulster, Washington, Wayne, Westchester

WAGES
These wages do not apply to Operating Engineers on land based construction projects. For those projects, please see the Operating Engineer Heavy/Highway Rates. The wage rates below for all equipment and operators are only for marine dredging work in navigable waters found in the counties listed above.

Per Hour:	07/01/2024
CLASS A1 Deck Captain, Leverman, Mechanical Dredge Operator, Licensed Tug Operator 1000HP or more.	$ 45.26
CLASS A2 Crane Operator (360 swing)	40.33
CLASS B Dozer, Front Loader Operator on Land	To conform to Operating Engineer Prevailing Wage in locality where work is being performed including benefits.
CLASS B1 Derrick Operator (180 swing) Spider/Spill Barge Operator Operator II, Fill Placer, Engineer Chief Mate, Electrician,Chief Welder, Maintenance Engineer,Licensed Boat, Crew Boat Operator	39.14
CLASS B2 Certified Welder	36.84
CLASS C1 Drag Barge Operator, Steward, Mate, Assistant Fill Placer	35.83
CLASS C2 Boat Operator	34.68

CLASS D Shoreman, Deckhand, Oiler, Rodman, Scowman, Cook, Messman, Porter/Janitor	28.81

SUPPLEMENTAL BENEFITS
Per Hour:
THE FOLLOWING SUPPLEMENTAL BENEFITS APPLY TO ALL CATEGORIES

All Classes A & B	$ 12.00 plus 7% of straight time wage, Overtime hours add $ 0.63
All Class C & D	$ 11.75 plus 7% of straight time wage, Overtime hours add $ 0.50

OVERTIME PAY
See (B2, F, R) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 15, 26) on HOLIDAY PAGE

4-25a-MarDredge

Operating Engineer - Survey Crew - Consulting Engineer — 03/01/2025

JOB DESCRIPTION Operating Engineer - Survey Crew - Consulting Engineer **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Suffolk, Westchester

PARTIAL COUNTIES
Dutchess: That part in Duchess County lying South of the North City line of Poughkeepsie.

WAGES
Feasibility and preliminary design surveying, any line and grade surveying for inspection or supervision of construction.

Per hour: 07/01/2024
Survey Classifications

Party Chief	$ 49.39
Instrument Man	40.96
Rodman	35.63

SUPPLEMENTAL BENEFITS
Per Hour:

All Crew Members: $ 23.75

OVERTIME PAY
OVERTIME:.... See (B, E*, Q, V) ON OVERTIME PAGE.
*Double-time paid on the 9th hour on Saturday.

HOLIDAY
Paid: See (5, 6, 7, 11, 16) on HOLIDAY PAGE
Overtime: See (5, 6, 7, 11, 16) on HOLIDAY PAGE

9-15dconsult

Painter — 03/01/2025

JOB DESCRIPTION Painter **DISTRICT** 8

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Suffolk, Westchester

WAGES

Per hour:	07/01/2024	05/01/2025 Additional
Brush	52.86*	$ 2.62**

Abatement/Removal of lead based or lead containing paint on materials to be repainted.	52.86*
Spray & Scaffold	$ 55.86*
Fire Escape	55.86*
Decorator	55.86*
Paperhanger/Wall Coverer	55.09*

*Subtract $ 0.10 to calculate premium rate.

** To be allocated at a later date.

SHIFT WORK
Counties of Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Suffolk, and Westchester; Agency/Government mandated off-shift work to be paid at time and one-half the hourly wage.

SUPPLEMENTAL BENEFITS
Per hour:

Paperhanger	$ 36.73
All others	34.31
Premium	38.28**

**Applies only to "All others" category, not paperhanger journeyworker.

OVERTIME PAY
See (A, E, R) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
One (1) year terms at the following wage rate.

Per hour:	07/01/2024
Appr 1st term...	$ 20.22*
Appr 2nd term...	25.93*
Appr 3rd term...	31.61*
Appr 4th term...	42.40*

*Subtract $ 0.10 to calculate premium rate.

Supplemental benefits:
Per Hour:

Appr 1st term...	$ 16.89
Appr 2nd term...	20.95
Appr 3rd term...	24.10
Appr 4th term...	30.57

8-NYDC9-B/S

Painter 03/01/2025

JOB DESCRIPTION Painter **DISTRICT** 8

ENTIRE COUNTIES
Putnam, Suffolk, Westchester

PARTIAL COUNTIES
Nassau: All of Nassau except the areas described below: Atlantic Beach, Ceaderhurst, East Rockaway, Gibson, Hewlett, Hewlett Bay, Hewlett Neck, Hewlett Park, Inwood, Lawrence, Lido Beach, Long Beach, parts of Lynbrook, parts of Oceanside, parts of Valley Stream, and Woodmere. Starting on the South side of Sunrise Hwy in Valley Stream running east to Windsor and Rockaway Ave., Rockville Centre is the boundary line up to Lawson Blvd. turn right going west all the above territory. Starting at Union Turnpike and Lakeville Rd. going north to Northern Blvd. the west side of Lakeville road to Northern blvd. At Northern blvd. going east the district north of Northern blvd. to Port Washington Blvd. West of Port Washington blvd.to St.Francis Hospital then north of first traffic light to Port Washington and Sands Point, Manor HAven, Harbour Acres.

WAGES

Per hour:	07/01/2024	05/01/2025
Drywall Taper:	$ 52.86*	Additional
Scaffold:	$ 55.86*	$ 2.62**

*Subtract $ 0.10 to calculate premium rate.

** To be allocated a later date.

SHIFT WORK
Agency/Government mandated off-shift work to be paid at time and one-half hourly wage

SUPPLEMENTAL BENEFITS
Per hour:
Journeyman $ 34.31

OVERTIME PAY
See (A, E, R) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages - Per Hour:

1500 hour terms at the following wage rate:

1st term	$ 20.22*
2nd term	25.93*
3rd term	31.61*
4th term	42.40*

*Subtract $ 0.10 to calculate premium rate.

Supplemental Benefits - Per hour:
One year term (1500 hours) at the following dollar amount.

1st year	$ 16.89
2nd year	20.95
3rd year	24.10
4th year	30.57

8-NYDCT9-DWT

Painter - Bridge & Structural Steel — 03/01/2025

JOB DESCRIPTION Painter - Bridge & Structural Steel **DISTRICT** 8

ENTIRE COUNTIES
Albany, Bronx, Clinton, Columbia, Dutchess, Essex, Franklin, Fulton, Greene, Hamilton, Kings, Montgomery, Nassau, New York, Orange, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Suffolk, Sullivan, Ulster, Warren, Washington, Westchester

WAGES
Per Hour:
STEEL:
Bridge Painting: 07/01/2024
$ 56.00
+ 10.35*

ADDITIONAL $7.00 per hour for POWER TOOL/SPRAY, whether straight time or overtime.

NOTE: All premium wages are to be calculated on base rate per hour only.

* For the period of May 1st to November 15th, this amount is payable up to 40 hours. For the period of Nov 16th to April 30th, this amount is payable up to 50 hours. EXCEPTION: First and last week of employment, and for the weeks of Memorial Day, Independence Day and Labor Day, where the amount is paid for the actual number of hours worked (50 hour cap).

NOTE: Generally, for Bridge Painting Contracts, ALL WORKERS on and off the bridge (including Flagmen) are to be paid Painter's Rate; the contract must be ONLY for Bridge Painting.

SHIFT WORK
When directly specified in public agency or authority contract documents for an employer to work a second shift and works the second shift with employees other than from the first shift, all employees who work the second shift will be paid 10% of the base wage shift differential in lieu of overtime for the first eight (8) hours worked after which the employees shall be paid at time and one half of the regular wage rate. When a single irregular work shift is mandated in the job specifications or by the contracting agency, wages shall be paid at time and one half for single shifts between the hours of 3pm-11pm or 11pm-7am.

SUPPLEMENTAL BENEFITS
Per Hour:

Journeyworker:

$ 12.43
+ 31.55*

* For the period of May 1st to November 15th, this amount is payable up to 40 hours. For the period of Nov 16th to April 30th, this amount is payable up to 50 hours. EXCEPTION: First and last week of employment, and for the weeks of Memorial Day, Independence Day and Labor Day, where the amount is paid for the actual number of hours worked (50 hour cap).

OVERTIME PAY
See (B, F, R) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (4, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wage - Per hour:
Apprentices: (1) year terms.

1st year	$ 22.40
	+ 4.14
2nd year	$ 33.60
	+ 6.21
3rd year	$ 44.80
	+ 8.28

Supplemental Benefits - Per hour:

1st year	$ 1.16
	+ 12.62
2nd year	$ 7.46
	+ 18.93
3rd year	$ 9.94
	+ 25.24

NOTE: All premium wages are to be calculated on base rate per hour only.

8-DC-9/806/155-BrSS

Painter - Line Striping — 03/01/2025

JOB DESCRIPTION Painter - Line Striping **DISTRICT** 8

ENTIRE COUNTIES
Albany, Clinton, Columbia, Dutchess, Essex, Franklin, Fulton, Greene, Hamilton, Montgomery, Nassau, Orange, Putnam, Rensselaer, Rockland, Saratoga, Schenectady, Schoharie, Suffolk, Sullivan, Ulster, Warren, Washington, Westchester

WAGES
Per hour:

Painter (Striping-Highway):	07/01/2024	04/01/2025	04/01/2026
Striping-Machine Operator*	$ 34.12	$ 35.49	$ 36.93
Linerman Thermoplastic	41.12	42.74	44.44

Note: * Includes but is not limited to: Positioning of cones and directing of traffic using hand held devices. Excludes the Driver/Operator of equipment used in the maintenance and protection of traffic safety.

SHIFT WORK
When directly specified in public agency or authority contract documents there shall be a 30% night shift premium pay differential for all work performed after 9:00pm and before 5:00am.

SUPPLEMENTAL BENEFITS
Per hour paid:
Journeyworker:

Striping Machine Operator:	$23.65	$ 24.30	$ 24.95
Linerman Thermoplastic:	23.65	24.30	24.95

OVERTIME PAY
See (B, B2, E2, F, S) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 20) on HOLIDAY PAGE
Overtime: See (5, 20) on HOLIDAY PAGE

REGISTERED APPRENTICES
One (1) year terms at the following wage rates:

	07/01/2024	01/01/2025	04/01/2025	04/01/2026
1st Term:	$ 16.00	$ 16.50	$ 16.50	$ 16.50
2nd Term:	20.47	20.47	21.29	22.16
3rd Term:	27.30	27.30	28.39	29.54
Supplemental Benefits per hour:				
All terms:	$ 23.65	$ 23.65	$ 24.30	$ 24.95

8-1456-LS

Painter - Metal Polisher — 03/01/2025

JOB DESCRIPTION Painter - Metal Polisher **DISTRICT** 8

ENTIRE COUNTIES
Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

	07/01/2024
Metal Polisher	$ 39.33
Metal Polisher*	40.43
Metal Polisher**	43.33

*Note: Applies on New Construction & complete renovation
** Note: Applies when working on scaffolds over 34 feet.

SUPPLEMENTAL BENEFITS
Per Hour: 07/01/2024

Journeyworker:
All classification $ 12.79

OVERTIME PAY
See (B, E, P, T) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages per hour:
One (1) year term at the following wage rates:

	07/01/2024
1st year	$ 19.67
2nd year	21.63
3rd year	23.60
1st year*	$ 22.06
2nd year*	22.07
3rd year*	24.14
1st year**	$ 22.17
2nd year**	24.13
3rd year**	26.10

*Note: Applies on New Construction & complete renovation
** Note: Applies when working on scaffolds over 34 feet.

Supplemental benefits:
Per hour:

1st year	$ 8.69
2nd year	8.69
3rd year	8.69

8-8A/28A-MP

Plumber 03/01/2025

JOB DESCRIPTION Plumber **DISTRICT** 8

ENTIRE COUNTIES
Putnam, Westchester

WAGES
Per hour:

	07/01/2024
Plumber and Steamfitter	$ 63.76

SHIFT WORK
SHIFT WORK:
When directly specified in public agency or authority contract documents, shift work outside the regular hours of work shall be comprised of eight (8) hours per shift not including Saturday, Sundays and holidays. One half (1/2) hour shall be allowed for lunch after the first four (4) hours of each shift. Wage and Fringes for shift work shall be straight time plus a shift premium of twenty-five (25%) percent. A minimum of five days Monday through Friday must be worked to establish shift work.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 43.61

OVERTIME PAY
See (B, E, E2, Q, V) on OVERTIME PAGE
OVERTIME:... See on OVERTIME PAGE.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
(1)year terms at the following wages:

1st Term	$ 23.75
2nd Term	27.23
3rd Term	31.47
4th Term	44.80
5th Term	48.05

Supplemental Benefits per hour:

1st term	$ 17.94
2nd term	20.05
3rd term	23.82
4th term	31.51
5th term	33.42

8-21.1-ST

Plumber - HVAC / Service 03/01/2025

JOB DESCRIPTION Plumber - HVAC / Service **DISTRICT** 8

ENTIRE COUNTIES
Dutchess, Putnam, Westchester

PARTIAL COUNTIES
Delaware: Only the townships of Middletown and Roxbury
Ulster: Entire County(including Wallkill and Shawangunk Prisons) except for remainder of Town of Shawangunk and Towns of Plattekill, Marlboro, and Wawarsing.

WAGES
Per hour: 07/01/2024

HVAC Service	$ 43.43

+ $ 4.47*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker HVAC Service
$ 30.39

OVERTIME PAY
See (B, F, R) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 16, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
HVAC SERVICE
(1)year terms at the following wages:

1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.
$ 19.66	$ 23.32	$ 29.05	$ 35.73	$ 38.83
+$2.43*	+$2.76*	+$3.31*	+$3.96*	+$4.21*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

Supplemental Benefits per hour:

Apprentices	07/01/2024
1st term	$ 21.47
2nd term	23.05
3rd term	24.76
4th term	27.13
5th term	28.81

8-21.1&2-SF/Re/AC

Plumber - Jobbing & Alterations 03/01/2025

JOB DESCRIPTION Plumber - Jobbing & Alterations **DISTRICT** 8

ENTIRE COUNTIES
Dutchess, Putnam, Westchester

PARTIAL COUNTIES
Ulster: Entire county (including Wallkill and Shawangunk Prisons in Town of Shawangunk) EXCEPT for remainder of Town of Shawangunk, and Towns of Plattekill, Marlboro, and Wawarsing.

WAGES
Per hour: 07/01/2024
Journeyworker: $ 49.63

Repairs, replacements and alteration work is any repair or replacement of a present plumbing system that does not change existing roughing or water supply lines.

SHIFT WORK
When directly specified in public agency or authority contract documents, shift work outside the regular hours of work shall be comprised of eight (8) hours per shift not including Saturday, Sundays and holidays. One half (1/2) hour shall be allowed for lunch after the first four (4) hours of each shift. Wage and Fringes for shift work shall be straight time plus a shift premium of twenty-five (25%) percent. A minimum of five days Monday through Friday must be worked to establish shift work.

SUPPLEMENTAL BENEFITS
Per hour:
Journeyworker
$ 36.44

OVERTIME PAY
See (B, *E, E2, Q, V) on OVERTIME PAGE
*When used as a make-up day, hours after 8 on Saturday shall be paid at time and one half.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
(1) year terms at the following wages:

1st year	$ 21.35
2nd year	23.73
3rd year	25.87
4th year	36.28
5th year	38.34

Supplemental Benefits per hour:

1st year	$ 12.11
2nd year	14.21
3rd year	18.38
4th year	24.86
5th year	26.96

8-21.3-J&A

Roofer — 03/01/2025

JOB DESCRIPTION Roofer **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Dutchess, Kings, New York, Orange, Putnam, Queens, Richmond, Rockland, Sullivan, Ulster, Westchester

WAGES
Per Hour: 07/01/2024

Roofer/Waterproofer $ 48.50
+ $7.00*

* This portion is not subjected to overtime premiums.

Note: Abatement/Removal of Asbestos containing roofs and roofing material is classified as Roofer.

SUPPLEMENTAL BENEFITS
Per Hour: $ 31.87

OVERTIME PAY
See (B, H) on OVERTIME PAGE
Note: An observed holiday that falls on a Sunday will be observed the following Monday.

HOLIDAY
Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES
(1) year term apprentices indentured prior to 01/01/2023

1st	2nd	3rd	4th
$ 16.97	$ 24.25	$ 29.10	$ 36.37
	+ 3.50*	+ 4.20*	+ 5.26*

Supplements:

1st	2nd	3rd	4th
$ 4.10	$ 16.17	$ 19.31	$ 24.02

* This portion is not subjected to overtime premiums.

(1) year term apprentices indentured after 01/01/2023

1st	2nd	3rd	4th	5th
$ 18.43	$ 21.82	$ 24.25	$ 29.10	$ 36.37
	+ 3.16*	+ 3.50*	+ 4.20*	+ 5.26

Supplements:

1st	2nd	3rd	4th	5th
$ 7.73	$ 14.59	$ 16.17	$ 19.31	$ 24.02

* This portion is not subjected to overtime premiums.

9-8R

Sheetmetal Worker — 03/01/2025

JOB DESCRIPTION Sheetmetal Worker **DISTRICT** 8

ENTIRE COUNTIES

Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, Westchester

WAGES

	07/01/2024
SheetMetal Worker	$ 49.51
	+ 3.71*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

SHIFT WORK
For all NYS D.O.T. and other Governmental mandated off-shift work:
10% increase for additional shifts for a minimum of five (5) days

SUPPLEMENTAL BENEFITS
Journeyworker $ 46.20

OVERTIME PAY
OVERTIME:.. See (B, E, Q,) on OVERTIME PAGE.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 15, 16, 23) on HOLIDAY PAGE

REGISTERED APPRENTICES

1st	2nd	3rd	4th	5th	6th	7th	8th
$ 20.20	$ 20.81	$ 23.12	$ 25.42	$ 27.74	$ 30.08	$ 32.86	$ 35.63
+ 1.48*	+ 1.67*	+ 1.86*	+ 2.04*	+ 2.23*	+ 2.41*	+ 2.60*	+ 2.78*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

Supplemental Benefits per hour:

Apprentices	
1st term	$ 18.07
2nd term	22.24
3rd term	24.71
4th term	27.21
5th term	29.67
6th term	32.12
7th term	34.12
8th term	36.15

Sheetmetal Worker — 03/01/2025

JOB DESCRIPTION Sheetmetal Worker **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES
Per Hour:

	07/01/2024	08/01/2024
Sign Erector	$ 58.00	$ 60.00

NOTE: Structurally Supported Overhead Highway Signs(See STRUCTURAL IRON WORKER CLASS)

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2024	08/01/2024
Sign Erector	$ 57.12	$ 58.31

OVERTIME PAY
See (B, F, S) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 10, 11, 12, 16, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 10, 11, 12, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
Per Hour:
6 month Terms at the following percentage of Sign Erectors wage rate:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
35%	40%	45%	50%	55%	60%	65%	70%	75%	80%

SUPPLEMENTAL BENEFITS
Per Hour:

	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
07/01/2024	$ 18.27	$ 20.75	$ 25.22	$ 25.70	$ 34.66	$ 37.74	$ 41.65	$ 44.78	$ 47.93	$ 51.04
08/01/2024	$ 18.65	$ 21.16	$ 23.69	$ 26.22	$35.39	$ 38.52	$ 42.55	$ 45.75	$ 48.96	$ 52.15

4-137-SE

Sprinkler Fitter — 03/01/2025

JOB DESCRIPTION Sprinkler Fitter **DISTRICT** 1

ENTIRE COUNTIES
Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, Westchester

WAGES

Per hour	07/01/2024
Sprinkler Fitter	$ 53.34

SUPPLEMENTAL BENEFITS

Per hour	
Journeyworker	$ 30.77

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
Note: When a holiday falls on Sunday, the following Monday shall be considered a holiday and all work performed on either day shall be at the double time rate. When a holiday falls on Saturday, the preceding Friday shall be considered a holiday and all work performed on either day shall be at the double time rate.

REGISTERED APPRENTICES
Wages per hour

One Half Year terms at the following wage.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
$ 25.89	$ 28.77	$ 31.39	$ 34.27	$ 37.14	$ 40.02	$ 42.90	$ 45.77	$ 48.65	$ 51.53

Supplemental Benefits per hour

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
$ 9.18	$ 9.18	$ 20.90	$ 20.90	$ 21.15	$ 21.15	$ 21.15	$ 21.15	$ 21.15	$ 21.15

1-669.2

Teamster - Building / Heavy&Highway — 03/01/2025

JOB DESCRIPTION Teamster - Building / Heavy&Highway **DISTRICT** 8

ENTIRE COUNTIES
Putnam, Westchester

WAGES
GROUP A: Straight Trucks (6-wheeler and 10-wheeler), A-frame, Winch, Dynamite Seeding, Mulching, Agitator, Water, Attenuator, Light Towers, Cement (all types), Suburban, Station Wagons, Cars, Pick Ups, any vehicle carrying materials of any kind.
GROUP AA: Tack Coat
GROUP B: Tractor & Trailers (all types).
GROUP BB: Tri-Axle,14 Wheeler
GROUP C: Low Boy (carrying equipment).
GROUP D: Fuel Trucks, Tire Trucks.
GROUP E: Off-road Equipment (over 40 tons): Athey Wagons, Belly Dumps, Articulated Dumps, Trailer Wagons.
GROUP F: Off-road Equipment (over 40 tons) Euclid, DJB.
GROUP G: Off-road Equipment (under 40 tons) Athey Wagons, Belly Articulated Dumps, Trailer Wagons.
GROUP H: Off-road Equipment(under 40 tons), Euclid.

GROUP HH: Off-road Equipment(under 40 tons) D.J.B.
GROUP I: Off-road Equipment(under 40 tons) Darts.
GROUP II: Off-road Equipment(under 40 tons) RXS.

WAGES:(per hour)

	07/01/2024
GROUP A	$ 47.86*
GROUP AA	50.86*
GROUP B	48.48*
GROUP BB	47.98*
GROUP C	50.61*
GROUP D	48.31*
GROUP E	48.86*
GROUP F	49.86*
GROUP G	48.61*
GROUP H	49.23*
GROUP HH	49.61*
GROUP I	49.36*
GROUP II	49.73*

* To calculate premium wage, subtract $ .10 from the hourly wage.

Note: Fuel truck operators on construction sites addit. $5.00 per day.
For work on hazardous/toxic waste site addit. 20% of hourly rate.

SHIFT WORK
When mandated by the contracting agency, DOT, or any governmental agency contracts shall receive a shift differential of fifteen (15%) above the wage rate.

SUPPLEMENTAL BENEFITS
Per hour:
Journeyworker

First 40 hours	$ 37.33
41st-45th hours	16.73
Over 45 hours	1.60

OVERTIME PAY
See (B, E, P, R) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 8, 15, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 15, 25) on HOLIDAY PAGE

8-456

Welder 03/01/2025

JOB DESCRIPTION Welder **DISTRICT** 1

ENTIRE COUNTIES
Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES
Per hour 07/01/2024

Welder: To be paid the same rate of the mechanic performing the work.*

*EXCEPTION: If a specific welder certification is required, then the 'Certified Welder' rate in that trade tag will be paid.

OVERTIME PAY

HOLIDAY

1-As Per Trade

Overtime Codes

Following is an explanation of the code(s) listed in the OVERTIME section of each classification contained in the attached schedule. Additional requirements may also be listed in the HOLIDAY section.

NOTE: Supplemental Benefits are 'Per hour worked' (for each hour worked) unless otherwise noted

(AA)	Time and one half of the hourly rate after 7 and one half hours per day
(A)	Time and one half of the hourly rate after 7 hours per day
(B)	Time and one half of the hourly rate after 8 hours per day
(B1)	Time and one half of the hourly rate for the 9th & 10th hours week days and the 1st 8 hours on Saturday. Double the hourly rate for all additional hours
(B2)	Time and one half of the hourly rate after 40 hours per week
(B3)	Time and one half of the hourly rate after 40 straight hours per week
(C)	Double the hourly rate after 7 hours per day
(C1)	Double the hourly rate after 7 and one half hours per day
(D)	Double the hourly rate after 8 hours per day
(D1)	Double the hourly rate after 9 hours per day
(E)	Time and one half of the hourly rate on Saturday
(E1)	Time and one half 1st 4 hours on Saturday; Double the hourly rate all additional Saturday hours
(E2)	Saturday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather
(E3)	Between November 1st and March 3rd Saturday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather, provided a given employee has worked between 16 and 32 hours that week
(E4)	Saturday and Sunday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather
(E5)	Double time after 8 hours on Saturdays
(F)	Time and one half of the hourly rate on Saturday and Sunday
(G)	Time and one half of the hourly rate on Saturday and Holidays
(H)	Time and one half of the hourly rate on Saturday, Sunday, and Holidays
(I)	Time and one half of the hourly rate on Sunday
(J)	Time and one half of the hourly rate on Sunday and Holidays
(K)	Time and one half of the hourly rate on Holidays
(L)	Double the hourly rate on Saturday
(M)	Double the hourly rate on Saturday and Sunday
(N)	Double the hourly rate on Saturday and Holidays
(O)	Double the hourly rate on Saturday, Sunday, and Holidays
(P)	Double the hourly rate on Sunday
(Q)	Double the hourly rate on Sunday and Holidays
(R)	Double the hourly rate on Holidays

(S)	Two and one half times the hourly rate for Holidays
(S1)	Two and one half times the hourly rate the first 8 hours on Sunday or Holidays One and one half times the hourly rate all additional hours.
(T)	Triple the hourly rate for Holidays
(U)	Four times the hourly rate for Holidays
(V)	Including benefits at SAME PREMIUM as shown for overtime
(W)	Time and one half for benefits on all overtime hours.
(X)	Benefits payable on Paid Holiday at straight time. If worked, additional benefit amount will be required for worked hours. (Refer to other codes listed.)

Holiday Codes

PAID Holidays:

Paid Holidays are days for which an eligible employee receives a regular day's pay, but is not required to perform work. If an employee works on a day listed as a paid holiday, this remuneration is in addition to payment of the required prevailing rate for the work actually performed.

OVERTIME Holiday Pay:

Overtime holiday pay is the premium pay that is required for work performed on specified holidays. It is only required where the employee actually performs work on such holidays. The applicable holidays are listed under HOLIDAYS: OVERTIME. The required rate of pay for these covered holidays can be found in the OVERTIME PAY section listings for each classification.

Following is an explanation of the code(s) listed in the HOLIDAY section of each classification contained in the attached schedule. The Holidays as listed below are to be paid at the wage rates at which the employee is normally classified.

(1)	None
(2)	Labor Day
(3)	Memorial Day and Labor Day
(4)	Memorial Day and July 4th
(5)	Memorial Day, July 4th, and Labor Day
(6)	New Year's, Thanksgiving, and Christmas
(7)	Lincoln's Birthday, Washington's Birthday, and Veterans Day
(8)	Good Friday
(9)	Lincoln's Birthday
(10)	Washington's Birthday
(11)	Columbus Day
(12)	Election Day
(13)	Presidential Election Day
(14)	1/2 Day on Presidential Election Day
(15)	Veterans Day
(16)	Day after Thanksgiving
(17)	July 4th
(18)	1/2 Day before Christmas
(19)	1/2 Day before New Years
(20)	Thanksgiving
(21)	New Year's Day
(22)	Christmas
(23)	Day before Christmas
(24)	Day before New Year's
(25)	Presidents' Day
(26)	Martin Luther King, Jr. Day
(27)	Memorial Day
(28)	Easter Sunday

(29) Juneteenth

New York State Department of Labor - Bureau of Public Work
State Office Building Campus
Building 12 - Room 130
Albany, New York 12226

REQUEST FOR WAGE AND SUPPLEMENT INFORMATION

As Required by Articles 8 and 9 of the NYS Labor Law

Fax (518) 485-1870 or mail this form for new schedules or for determination for additional occupations.

This Form Must Be Typed

Submitted By: (Check Only One) ☐ Contracting Agency ☐ Architect or Engineering Firm ☐ Public Work District Office Date:

A. Public Work Contract to be let by: (Enter Data Pertaining to Contracting/Public Agency)

1. Name and complete address ☐ (Check if new or change)

Telephone Fax

E-Mail:

2. NY State Units (see Item 5).

- ☐ 01 DOT
- ☐ 02 OGS
- ☐ 03 Dormitory Authority
- ☐ 04 State University Construction Fund
- ☐ 05 Mental Hygiene Facilities Corp.
- ☐ 06 OTHER N.Y. STATE UNIT
- ☐ 07 City
- ☐ 08 Local School District
- ☐ 09 Special Local District, i.e., Fire, Sewer, Water District
- ☐ 1O Village
- ☐ 11 Town
- ☐ 12 County
- ☐ 13 Other Non-N.Y. State (Describe)

3. SEND REPLY TO ☐ (check if new or change)
Name and complete address:

Telephone Fax

E-Mail:

4. SERVICE REQUIRED. Check appropriate box and provide project information.

☐ New Schedule of Wages and Supplements.

APPROXIMATE BID DATE :

☐ Additional Occupation and/or Redetermination

PRC NUMBER ISSUED PREVIOUSLY FOR THIS PROJECT :

OFFICE USE ONLY

B. PROJECT PARTICULARS

5. Project Title _____

Description of Work _____

Contract Identification Number _____

Note: For NYS units, the OSC Contract No. _____

6. Location of Project:
Location on Site _____

Route No/Street Address _____

Village or City _____

Town _____

County _____

7. Nature of Project - Check One:

- ☐ 1. New Building
- ☐ 2. Addition to Existing Structure
- ☐ 3. Heavy and Highway Construction (New and Repair)
- ☐ 4. New Sewer or Waterline
- ☐ 5. Other New Construction (Explain)
- ☐ 6. Other Reconstruction, Maintenance, Repair or Alteration
- ☐ 7. Demolition
- ☐ 8. Building Service Contract

8. OCCUPATION FOR PROJECT :

- ☐ Construction (Building, Heavy Highway/Sewer/Water)
- ☐ Tunnel
- ☐ Residential
- ☐ Landscape Maintenance
- ☐ Elevator maintenance
- ☐ Exterminators, Fumigators
- ☐ Fire Safety Director, NYC Only
- ☐ Fuel Delivery
- ☐ Guards, Watchmen
- ☐ Janitors, Porters, Cleaners, Elevator Operators
- ☐ Moving furniture and equipment
- ☐ Trash and refuse removal
- ☐ Window cleaners
- ☐ Other (Describe)

9. Does this project comply with the Wicks Law involving separate bidding? YES ☐ NO ☐

10. Name and Title of Requester

Signature

SEE PAGE TWO FOR LAWS RELATING TO PUBLIC WORK CONTRACTS

NEW YORK STATE DEPARTMENT OF LABOR
Bureau of Public Work - Debarment List

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Under Article 8 and Article 9 of the NYS Labor Law, a contractor, sub-contractor and/or its successor shall be debarred and ineligible to submit a bid on or be awarded any public work or public building service contract/sub-contract with the state, any municipal corporation or public body for a period of five (5) years from the date of debarment when:

- Two (2) final determinations have been rendered within any consecutive six-year (6) period determining that such contractor, sub-contractor and/or its successor has WILLFULLY failed to pay the prevailing wage and/or supplements;
- One (1) final determination involves falsification of payroll records or the kickback of wages and/or supplements.

The agency issuing the determination and providing the information, is denoted under the heading 'Fiscal Officer'. DOL = New York State Department of Labor; NYC = New York City Comptroller's Office; AG = New York State Attorney General's Office; DA = County District Attorney's Office.

Debarment Database: To search for contractors, sub-contractors and/or their successors debarred from bidding or being awarded any public work contract or subcontract under NYS Labor Law Articles 8 and 9, or under NYS Workers' Compensation Law Section 141-b, access the database at this link: https://apps.labor.ny.gov/EDList/searchPage.do

For inquiries please call 518-457-5589.

NYSDOL Bureau of Public Work Debarment List 03/14/2025

Article 8

AGENCY	Fiscal Officer	FEIN	EMPLOYER NAME	EMPLOYER DBA NAME	ADDRESS	DEBARMENT START DATE	DEBARMENT END DATE
DOL	DOL	*****5754	0369 CONTRACTORS, LLC		515 WEST AVE UNIT PH 13NORWALK CT 06850	05/12/2021	05/12/2026
DOL	DOL	*****5784	A.J.M. TRUCKING, INC.		PO BOX 2064 MONROE NY 10950	02/12/2024	02/12/2029
DOL	DOL		AKHLAQ OULAKH		4307 28TH AVE ASTORIA NY 11103	10/11/2024	10/11/2029
DOL	NYC		ALL COUNTY SEWER & DRAIN, INC.		7 GREENFIELD DR WARWICK NY 10990	03/25/2022	03/25/2027
DOL	DOL	*****8387	AMERICAN PAVING & MASONRY, CORP.		8 FOREST AVE GLEN COVE NY 11542	05/24/2024	05/24/2029
DOL	DOL	*****8654	AMERICAN PAVING, INC.		8 FORREST AVE. GLEN COVE NY 11542	05/24/2024	05/24/2029
DOL	NYC		AMJED PARVEZ		401 HANOVER AVENUE STATEN ISLAND NY 10304	01/11/2021	01/11/2026
DOL	DOL		ANGELO F COKER		2610 SOUTH SALINA STREET SUITE 14SYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL		ANGELO GARCIA		515 WEST AVE UNIT PH 13NORWALK CT 06850	05/12/2021	05/12/2026
DOL	DOL		ANGELO STANCO		8 FOREST AVE. GLEN COVE NY 11542	05/24/2024	05/24/2029
DOL	DOL		ANGELO TONDO		449 WEST MOMBSHA ROAD MONROE NY 10950	06/06/2022	06/06/2027
DOL	DOL	*****4231	ANKER'S ELECTRIC SERVICE, INC.		10 SOUTH 5TH ST LOCUST VALLEY NY 11560	09/26/2022	09/26/2027
DOL	DOL		ANTHONY MONGELLI		PO BOX 2064 MONROE NY 10950	02/12/2024	02/12/2029
DOL	NYC		ARADCO CONSTRUCTION CORP		115-46 132RD ST SOUTH OZONE PARK NY 11420	09/17/2020	09/17/2025
DOL	NYC		AVM CONSTRUCTION CORP		117-72 123RD ST SOUTH OZONE PARK NY 11420	09/17/2020	09/17/2025
DOL	NYC		AZIDABEGUM		524 MCDONALD AVENUE BROOKLYN NY 11218	09/17/2020	09/17/2025
DOL	DOL	*****8421	B & B DRYWALL, INC		206 WARREN AVE APT 1WHITE PLAINS NY 10603	12/14/2021	12/14/2026
DOL	DOL		B&L RENOVATION CO.		618 OCEAN PARKWAY APT A6BROOKLYN NY 11230	09/17/2020	09/17/2025
DOL	NYC	*****2113	BHW CONTRACTING, INC.		401 HANOVER AVENUE STATEN ISLAND NY 10304	01/11/2021	01/11/2026
DOL	DOL	*****5078	BLACK RIVER TREE REMOVAL, LLC		29807 ANDREWS ROAD BLACK RIVER NY 13032	10/17/2023	10/17/2028
DOL	DOL		BRADLEY J SCHUKA		4 BROTHERS ROAD WAPPINGERS FALLS NY 12590	10/20/2020	10/20/2025
DOL	DOL	*****9383	C.C. PAVING AND EXCAVATING, INC.		2610 SOUTH SALINA ST SUITE 12SYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL	*****5161	CALADRI DEVELOPMENT CORP.		1223 PARK ST. PEEKSKILL NY 10566	05/17/2021	05/17/2026
DOL	DOL	*****3391	CALI ENTERPRISES, INC.		1223 PARK STREET PEEKSKILL NY 10566	05/17/2021	05/17/2026
DOL	DOL	*****4155	CASA BUILDERS, INC.	FRIEDLANDER CONSTRUCTION	64 N PUTT CONNERS ROAD NEW PALTZ NY 12561	05/10/2023	05/10/2028
DOL	AG	*****7247	CENTURY CONCRETE CORP		2375 RAYNOR ST RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	DOL	*****0026	CHANTICLEER CONSTRUCTION LLC		4 BROTHERS ROAD WAPPINGERS FALLS NY 12590	10/20/2020	10/20/2025
DOL	NYC	*****2117	CHARAN ELECTRICAL ENTERPRISES		9-11 40TH AVENUE LONG ISLAND CITY NY 11101	09/26/2023	09/26/2028
DOL	DOL		CHRISTOPHER GRECO		26 NORTH MYRTLE AVENUE SPRING VALLEY NY 10956	02/18/2021	02/18/2026
DOL	DOL	*****2281	CORRAO TRUCKING, INC.		PO BOX 393 NANUET NY 10954	09/17/2024	09/17/2029
DOL	DOL		CRAIG JOHANSEN		10 SOUTH 5TH ST LOCUST VALLEY NY 11560	09/26/2022	09/26/2027
DOL	DOL	*****3228	CROSS-COUNTY LANDSCAPING AND TREE SERVICE, INC.	ROCKLAND TREE SERVICE	26 NORTH MYRTLE AVENUE SPRING VALLEY NY 10956	02/18/2021	02/18/2026
DOL	DOL	*****7619	DANCO CONSTRUCTION UNLIMITED INC.		485 RAFT AVENUE HOLBROOK NY 11741	10/19/2021	10/19/2026
DOL	DOL		DANIEL ROBERT MCNALLY		7 GREENFIELD DRIVE WARWICK NY 10990	03/25/2022	03/25/2027

NYSDOL Bureau of Public Work Debarment List 03/14/2025

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DOL	DOL		DARIAN L COKER		2610 SOUTH SALINA ST SUITE 2CSYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL		DARWIN PEGUESE		6400 BALTIMORE NATIONAL SUITE 602CANTONSVILLE NY 21228	10/24/2024	10/24/2029
DOL	DOL		DAVID FRIEDLANDER		64 NORTH PUTT CORNERS RD NEW PALTZ NY 12561	05/10/2023	05/10/2028
DOL	DOL		DINA TAYLOR		64 N PUTT CONNERS RD NEW PALTZ NY 12561	05/10/2023	05/10/2028
DOL	AG		EDWIN HUTZLER		23 NORTH HOWELLS RD BELLPORT NY 11713	08/04/2021	08/04/2026
DOL	DA		EDWIN HUTZLER		2375 RAYNOR STREET RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	DOL	*****0780	EMES HEATING & PLUMBING CONTR		5 EMES LANE MONSEY NY 10952	01/20/2002	01/20/3002
DOL	DOL		EMIL KISZKO		84 DIAMOND ST BROOKLYN NY 11222	07/18/2024	07/18/2029
DOL	DOL	*****3298	EMJACK CONSTRUCTION CORP.		84 DIAMOND ST BROOKLYN NY 11222	07/18/2024	07/18/2029
DOL	DOL	*****3298	EMJACK CONSTRUCTION LLC		4192 SIR ANDREW CIRCLE DOYLESTOWN PA 18902	07/18/2024	07/18/2029
DOL	DOL		EUGENIUSZ "GINO" KUCHAR		195 KINGSLAND AVE BROOKLYN NY 11222	12/22/2023	12/22/2028
DOL	DA		FREDERICK HUTZLER		2375 RAYNOR STREET RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	DOL	*****2998	G.E.M. AMERICAN CONSTRUCTION CORP.		195 KINGSLAND AVE BROOKLYN NY 11222	12/22/2023	12/22/2028
DOL	NYC		GAYATRI MANGRU		21 DAREWOOD LANE VALLEY STREAM NY 11581	09/17/2020	09/17/2025
DOL	DA		GEORGE LUCEY		150 KINGS STREET BROOKLYN NY 11231	01/19/1998	01/19/2998
DOL	DA		GIOVANNA TRAVALJA		3735 9TH ST LONG ISLAND CITY NY 11101	01/05/2023	01/05/2028
DOL	DA		GIOVANNI NAPOLITANO		2501 BAYVIEW AVENUE WANTAGH NY 11793	02/21/2024	02/21/2029
DOL	DA	*****0213	GORILLA CONTRACTING GROUP, LLC		505 MANHATTAN AVE WEST BABYLON NY 11704	10/05/2023	10/05/2028
DOL	DA	*****4760	GTX CONSTRUCTION ASSOCIATES, CORP		2501 BAYVIEW AVE WANTAGH NY 11793	02/21/2024	02/21/2029
DOL	DOL		HERBERT CLEMEN		42 FOWLER AVENUE CORTLAND MANOR NY 10567	01/24/2023	01/24/2028
DOL	DOL		HERBERT CLEMEN		42 FOWLER AVENUE CORTLAND MANOR NY 10567	10/25/2022	10/25/2027
DOL	DOL	*****2397	ISLAND BREEZE MARINE, INC.		6400 BALTIMORE NATIONAL CANTONSVILLE MD 21228	10/24/2024	10/24/2029
DOL	DOL	*****9211	J. WASE CONSTRUCTION CORP.		8545 RT 9W ATHENS NY 12015	03/09/2021	03/09/2026
DOL	DOL		J.M.J CONSTRUCTION		151 OSTRANDER AVENUE SYRACUSE NY 13205	11/21/2022	11/21/2027
DOL	DOL		J.R. NELSON CONSTRUCTION		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		J.R. NELSON CONSTRUCTION		531 THIRD STREET ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL		J.R. NELSON CONSTRUCTION		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		J.R. NELSON, LLC		531 THIRD STREET ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL		J.R. NELSON, LLC		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		J.R. NELSON, LLC		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		J.R.N COMPANIES, LLC		531 THIRD STREET ALBANY NY 12206	12/12/2022	12/12/2027
DOL	DOL		J.R.N COMPANIES, LLC		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		J.R.N COMPANIES, LLC		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL	*****1147	J.R.N. CONSTRUCTION, LLC		531 THIRD ST ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL	*****1147	J.R.N. CONSTRUCTION, LLC		531 THIRD ST ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL	*****1147	J.R.N. CONSTRUCTION, LLC		531 THIRD ST ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		JAMES J. BAKER		7901 GEE ROAD CANASTOTA NY 13032	08/17/2021	08/17/2026

DOL	DOL		JASON P. RACE		3469 STATE RT. 69 PERISH NY 13131	09/29/2021	09/29/2026
DOL	DOL		JASON P. RACE		3469 STATE RT. 69 PERISH NY 13131	02/09/2022	02/09/2027
DOL	DOL		JASON P. RACE		3469 STATE RT. 69 PERISH NY 13131	11/15/2022	11/15/2027
DOL	DOL		JASON P. RACE		3469 STATE RT. 69 PERISH NY 13131	03/01/2022	03/01/2027
DOL	DOL	*****7993	JBS DIRT, INC.		7901 GEE ROAD CANASTOTA NY 13032	08/17/2021	08/17/2026
DOL	DOL	*****2435	JEFFEL D. JOHNSON	JMJ7 AND SON	5553 CAIRNSTRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JEFFEL JOHNSON ELITE CARPENTER REMODEL AND CONSTRUCTION		C2 EVERGREEN CIRCLE LIVERPOOL NY 13090	11/21/2022	11/21/2027
DOL	DOL	*****2435	JEFFREY M. JOHNSON	JMJ7 AND SON	5553 CAIRNS TRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JIM PLAUGHER		17613 SANTE FE LINE ROAD WAYNEFIELD OH 45896	07/16/2021	07/16/2026
DOL	DOL		JMJ7 & SON CONSTRUCTION, LLC		5553 CAIRNS TRAIL LIVERPOOL NY 13041	11/21/2022	11/21/2027
DOL	DOL		JMJ7 AND SONS CONTRACTORS		5553 CAIRNS TRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JMJ7 CONTRACTORS		7014 13TH AVENUE BROOKLYN NY 11228	11/21/2022	11/21/2027
DOL	DOL		JMJ7 CONTRACTORS AND SONS		5553 CAIRNS TRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JMJ7 CONTRACTORS, LLC		5553 CAIRNS TRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JOHN MARKOVIC		47 MANDON TERRACE HAWTHORN NJ 07506	03/29/2021	03/29/2026
DOL	DOL		JOHN WASE		8545 RT 9W ATHENS NY 12015	03/09/2021	03/09/2026
DOL	DOL		JORGE RAMOS		8970 MIKE GARCIA DR MANASSAS VA 20109	07/16/2021	07/16/2026
DOL	DOL		JOSEPH K. SALERNO		1010 TILDEN AVE UTICA NY 13501	07/24/2023	07/24/2028
DOL	DOL		JOSEPH K. SALERNO II		1010 TILDEN AVE UTICA NY 13501	07/24/2023	07/24/2028
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	02/09/2022	02/09/2027
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	11/15/2022	11/15/2027
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	09/29/2021	09/29/2026
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	03/01/2022	03/01/2027
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	03/01/2022	03/01/2027
DOL	DOL		JRN CONSTRUCTION CO, LLC		1024 BROADWAY ALBANY NY 12204	11/07/2023	11/07/2028
DOL	DOL	*****1147	JRN CONSTRUCTION, LLC		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL	*****1147	JRN CONSTRUCTION, LLC		531 THIRD STREET ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL	*****1147	JRN CONSTRUCTION, LLC		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		JRN PAVING, LLC		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		JRN PAVING, LLC		531 THIRD STREET ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL		JRN PAVING, LLC		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		JULIUS AND GITA BEHREND		5 EMES LANE MONSEY NY 10952	11/20/2002	11/20/3002
DOL	DOL		KARIN MANGIN		796 PHELPS ROAD FRANKLIN LAKES NJ 07417	12/01/2020	12/01/2025
DOL	DOL		KATE E. CONNOR		7088 INTERSTATE ISLAND RD SYRACUSE NY 13209	03/31/2021	03/31/2026
DOL	DOL		KEAN INDUSTRIES, LLC		2345 RT. 52 SUITE 2NHOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	DOL	*****2959	KELC DEVELOPMENT, INC		7088 INTERSTATE ISLAND RD SYRACUSE NY 13209	03/31/2021	03/31/2026

DOL	DOL		KIMBERLY F. BAKER		7901 GEE ROAD CANASTOTA NY 13032	08/17/2021	08/17/2026
DOL	DOL		KMA GROUP II, INC.		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028
DOL	DOL	*****1833	KMA GROUP INC.		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028
DOL	DOL		KMA INSULATION, INC.		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028
DOL	DOL		KRIN HEINEMANN		2345 ROUTE 52, SUITE 2N HOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	NYC		KULWANT S. DEOL		9-11 40TH AVENUE LONG ISLAND CITY NY 11101	09/26/2023	09/26/2028
DOL	DA	*****8816	LAKE CONSTRUCTION AND DEVELOPMENT CORPORATION		150 KINGS STREET BROOKLYN NY 11231	08/19/1998	08/19/2998
DOL	DOL		LEROY E. NELSON JR		531 THIRD ST ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		LEROY E. NELSON JR		531 THIRD ST ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL		LEROY E. NELSON JR		531 THIRD ST ALBANY NY 12206	11/07/2023	11/07/2028
DOL	AG	*****3291	LINTECH ELECTRIC, INC.		3006 TILDEN AVE BROOKLYN NY 11226	02/16/2022	02/16/2027
DOL	DOL		LOUIS A. CALICCHIA		1223 PARK ST. PEEKSKILL NY 10566	05/17/2021	05/17/2026
DOL	DOL	*****2196	MAINSTREAM SPECIALTIES, INC.		11 OLD TOWN RD SELKIRK NY 12158	02/02/2021	02/02/2026
DOL	DA		MANUEL P TOBIO		150 KINGS STREET BROOKLYN NY 14444	08/19/1998	08/19/2998
DOL	DA		MANUEL TOBIO		150 KINGS STREET BROOKLYN NY 11231	08/19/1998	08/19/2998
DOL	DOL		MAQSOOD AHMAD		618 OCEAN PKWY BROOKLYN NY 11230	09/17/2020	09/17/2025
DOL	DOL	*****1320	MJC MASON CONTRACTING, INC.		42 FOWLER AVENUE CORTLAND MANOR NY 10567	10/25/2022	10/25/2027
DOL	DOL	*****1320	MJC MASON CONTRACTING, INC.		42 FOWLER AVENUE CORTLAND MANOR NY 10567	01/24/2023	01/24/2028
DOL	NYC		MUHAMMED A. HASHEM		524 MCDONALD AVENUE BROOKLYN NY 11218	09/17/2020	09/17/2025
DOL	DOL	*****7790	NATIONAL BUILDING & RESTORATION CORP		1010 TILDEN AVE UTICA NY 13501	07/24/2023	07/24/2028
DOL	DOL	*****1797	NATIONAL CONSTRUCTION SERVICES, INC		1010 TILDEN AVE UTICA NY 13501	07/24/2023	07/24/2028
DOL	NYC		NAVIT SINGH		402 JERICHO TURNPIKE NEW HYDE PARK NY 11040	08/10/2022	08/10/2027
DOL	DOL		NELCO CONTRACTING, LLC		1024 BROADWAY ALBANY NY 12204	11/07/2023	11/07/2028
DOL	DA		NICHOLAS T. ANALITIS		505 MANHATTAN AVE WEST BABYLON NY 11704	10/05/2023	10/05/2028
DOL	DOL		NICHOLE E. FRASER A/K/A NICHOLE RACE		3469 STATE RT. 69 PERISH NY 13131	03/01/2022	03/01/2027
DOL	DOL		NICHOLE E. FRASER A/K/A NICHOLE RACE		3469 STATE RT. 69 PERISH NY 13131	11/15/2022	11/15/2027
DOL	DOL		NICHOLE E. FRASER A/K/A NICHOLE RACE		3469 STATE RT. 69 PERISH NY 13131	09/29/2021	09/29/2026
DOL	DOL		NICHOLE E. FRASER A/K/A NICHOLE RACE		3469 STATE RT. 69 PERISH NY 13131	02/09/2022	02/09/2027
DOL	DOL	*****7429	NICOLAE I. BARBIR	BESTUCCO CONSTRUCTION, INC.	444 SCHANTZ ROAD ALLENTOWN PA 18104	09/17/2020	09/17/2025
DOL	NYC	*****5643	NYC LINE CONTRACTORS, INC.		402 JERICHO TURNPIKE NEW HYDE PARK NY 11040	08/10/2022	08/10/2027
DOL	DOL		PATRICK PENNACCHIO		2345 RT. 52 SUITE 2NHOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	DOL		PATRICK PENNACCHIO		2345 RT. 52 SUITE 2NHOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	DOL		PAULINE CHAHALES		935 S LAKE BLVD MAHOPAC NY 10541	03/02/2021	03/02/2026
DOL	DOL		PETER STEVENS		11 OLD TOWN ROAD SELKIRK NY 12158	02/02/2021	02/02/2026
DOL	DOL		PETER STEVENS		8269 21ST ST BELLEROSE NY 11426	12/22/2022	12/22/2027

DOL	DOL	*****4168	PHANTOM CONSTRUCTION CORP.		95-27 116TH STREET QUEENS NY 11419	07/12/2024	07/12/2029
DOL	DOL	*****4168	PHANTOM CONSTRUCTION CORP.		95-27 116TH STREET QUEENS NY 11419	05/28/2024	05/28/2029
DOL	NYC		RASHEL CONSTRUCTION CORP		524 MCDONALD AVENUE BROOKLYN NY 11218	09/17/2020	09/17/2025
DOL	DOL	*****2633	RAW POWER ELECTRIC CORP.		3 PARK CIRCLE MIDDLETOWN NY 10940	07/11/2022	07/11/2027
DOL	DA	*****7559	REGAL CONTRACTING INC.		24 WOODBINE AVE NORTHPORT NY 11768	10/01/2020	10/01/2025
DOL	DOL		ROBBYE BISSESAR		89-51 SPRINGFIELD BLVD QUEENS VILLAGE NY 11427	01/11/2003	01/11/3003
DOL	DOL		ROMEO WARREN		161 ROBYN RD MONROE NY 10950	07/11/2022	07/11/2027
DOL	DOL	*****7172	RZ & AL INC.		198 RIDGE AVENUE VALLEY STREAM NY 11581	06/06/2022	06/06/2027
DOL	DOL		SAL FRESINA MASONRY CONTRACTORS, INC.		1935 TEALL AVENUE SYRACUSE NY 13206	07/16/2021	07/16/2026
DOL	DOL		SAL MASONRY CONTRACTORS, INC.		(SEE COMMENTS) SYRACUSE NY 13202	07/16/2021	07/16/2026
DOL	DOL	*****9874	SALFREE ENTERPRISES INC		P.O BOX 14 2821 GARDNER RDPOMPEI NY 13138	07/16/2021	07/16/2026
DOL	DOL		SALVATORE A FRESINA A/K/A SAM FRESINA		107 FACTORY AVE P.O BOX 11070SYRACUSE NY 13218	07/16/2021	07/16/2026
DOL	DOL		SAM FRESINA		107 FACTORY AVE P.O BOX 11070SYRACUSE NY 13218	07/16/2021	07/16/2026
DOL	DA	*****0476	SAMCO ELECTRIC CORP.		3735 9TH ST LONG ISLAND CITY NY 11101	01/05/2023	01/05/2028
DOL	DA		SILVANO TRAVALJA		3735 9TH ST LONG ISLAND CITY NY 11101	01/05/2023	01/05/2028
DOL	DOL	*****0440	SOLAR GUYS INC.		8970 MIKE GARCIA DR MANASSAS VA 20109	07/16/2021	07/16/2026
DOL	NYC		SOMATIE RAMSUNAHAI		115-46 132ND ST SOUTH OZONE PARK NY 11420	09/17/2020	09/17/2025
DOL	NYC	*****3661	SPANIER BUILDING MAINTENANCE CORP		200 OAK DRIVE SYOSSET NY 11791	03/14/2022	03/14/2027
DOL	DOL		STANADOS KALOGELAS		485 RAFT AVENUE HOLBROOK NY 11741	10/19/2021	10/19/2026
DOL	DOL	*****3496	STAR INTERNATIONAL INC		89-51 SPRINGFIELD BLVD QUEENS VILLAGE NY 11427	08/11/2003	08/11/3003
DOL	DOL	*****9528	STEEL-IT, LLC.		17613 SANTE FE LINE ROAD WAYNESFIELD OH 45896	07/16/2021	07/16/2026
DOL	DOL	*****3800	SUBURBAN RESTORATION CO. INC.		5-10 BANTA PLACE FAIR LAWN PLACE NJ 07410	03/29/2021	03/29/2026
DOL	DOL	*****9150	SURGE INC.		8269 21ST STREET BELLEROSE NY 11426	12/22/2022	12/22/2027
DOL	DOL		SYED MUHAMMAD S. JAFRI A/K/A SHARRUKH JAFRI		4307 28TH AVE ASTORIA NY 11103	10/11/2024	10/11/2029
DOL	DOL		SYED RAZA		198 RIDGE AVENUE NY 11581	06/06/2022	06/06/2027
DOL	DOL		TARLOK SINGH		95-27 116TH STREET QUEENS NY 11419	05/28/2024	05/28/2029
DOL	DOL		TARLOK SINGH		95-27 116TH STREET QUEENS NY 11419	07/12/2024	07/12/2029
DOL	DOL	*****9733	TERSAL CONSTRUCTION SERVICES INC		107 FACTORY AVE P.O BOX 11070SYRACUSE NY 13208	07/16/2021	07/16/2026
DOL	DOL		TERSAL CONTRACTORS, INC.		221 GARDNER RD P.O BOX 14POMPEI NY 13138	07/16/2021	07/16/2026
DOL	DOL		TERSAL DEVELOPMENT CORP.		1935 TEALL AVENUE SYRACUSE NY 13206	07/16/2021	07/16/2026
DOL	DOL	*****5766	THE COKER CORPORATION	COKER CORPORATIO N	2610 SOUTH SALINA ST SUITE 14SYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL	*****2426	THE MATRUKH GROUP, INC.		4307 28TH AVE PO BOX 9082ASTORIA NY 11103	10/11/2024	10/11/2029
DOL	DOL		TIMOTHY PERCY		29807 ANDREWS ROAD BLACK RIVER NY 13612	10/17/2023	10/17/2028
DOL	DA	*****1050	TRI STATE CONSTRUCTION OF NY CORP.		50-39 175TH PLACE FRESH MEADOWS NY 11365	03/28/2022	03/28/2027

NYSDOL Bureau of Public Work Debarment List 03/14/2025

Article 8

DOL	DA	*****4106	TRIPLE H CONCRETE CORP		2375 RAYNOR STREET RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	DOL	*****8210	UPSTATE CONCRETE & MASONRY CONTRACTING CO INC		449 WEST MOMBSHA ROAD MONROE NY 10950	06/06/2022	06/06/2027
DOL	DOL	*****6418	VALHALLA CONSTRUCTION, LLC.		796 PHLEPS ROAD FRANKLIN LAKES NJ 07417	12/01/2020	12/01/2025
DOL	NYC	*****2426	VICKRAM MANGRU	VICK CONSTRUCTION	21 DAREWOOD LANE VALLEY STREAM NY 11581	09/17/2020	09/17/2025
DOL	NYC		VICKRAM MANGRU		21 DAREWOOD LANE VALLEY STREAM NY 11581	09/17/2020	09/17/2025
DOL	DOL		VINCENT CORRAO		PO BOX 393 NANUET NY 10954	09/17/2024	09/17/2029
DOL	DOL	*****8266	WILLIAM CHRIS MCCLENDON	MCCLENDON ASPHALT PAVING	1646 FALLS STREET NIAGARA FALLS NY 14303	05/01/2023	05/01/2028
DOL	DOL		WILLIAM CHRIS MCCLENDON		1646 FALLS STREET NIAGARA FALLS NY 14303	05/01/2023	05/01/2028
DOL	DOL		WILLIAM G. PROERFRIEDT		85 SPRUCEWOOD ROAD WEST BABYLON NY 11704	01/19/2021	01/19/2026
DOL	DOL	*****5924	WILLIAM G. PROPHY, LLC	WGP CONTRACTING, INC.	54 PENTAQUIT AVE BAYSHORE NY 11706	01/19/2021	01/19/2026
DOL	DOL		WILLIAM SCRIVENS		4192 SIR ANDREW CIRCLE DOYELSTOWN PA 18902	07/18/2024	07/18/2029
DOL	DOL		XENOFON EFTHIMIADIS		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028

U.S. Department of Labor
Wage and Hour Division

PAYROLL

For contractor's optional use; see instructions at dol.gov/agencies/whd/forms/wh347

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

WAGE AND HOUR DIVISION
Revised December 2008

OMB No. 1235-0008
Expires 09/30/2026

NAME OF CONTRACTOR ☐ OR SUBCONTRACTOR ☐	ADDRESS	
PAYROLL NO.	FOR WEEK ENDING	PROJECT AND LOCATION / PROJECT OR CONTRACT NO.

(1) NAME AND INDIVIDUAL IDENTIFYING NUMBER (e.g., LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER) OF WORKER	(2) NO. OF WITHHOLDING EXEMPTIONS	(3) WORK CLASSIFICATION	OT. OR ST.	(4) DAY AND DATE — HOURS WORKED EACH DAY	(5) TOTAL HOURS	(6) RATE OF PAY	(7) GROSS AMOUNT EARNED	(8) DEDUCTIONS: FICA	WITH-HOLDING TAX			OTHER	TOTAL DEDUCTIONS	(9) NET WAGES PAID FOR WEEK
			O											
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While completion of Form WH-347 is optional, it is mandatory for covered contractors and subcontractors performing work on Federally financed or assisted construction contracts to respond to the information collection contained in 29 C.F.R. §§ 3.3, 5.5(a). The Copeland Act (40 U.S.C. § 3145) contractors and subcontractors performing work on Federally financed or assisted construction contracts to "furnish weekly a statement with respect to the wages paid each employee during the preceding week." U.S. Department of Labor (DOL) regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" indicating that the payrolls are correct and complete and that each laborer or mechanic has been paid not less than the proper Davis-Bacon prevailing wage rate for the work performed. DOL and federal contracting agencies receiving this information review the information to determine that employees have received legally required wages and fringe benefits.

Public Burden Statement

We estimate that is will take an average of 55 minutes to complete this collection, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W. Washington, D.C. 20210

(over)

Date _____

I, _____ _____
(Name of Signatory Party) (Title)

do hereby state:

(1) That I pay or supervise the payment of the persons employed by

_____ on the
(Contractor or Subcontractor)

_____; that during the payroll period commencing on the
(Building or Work)

_____ day of _____, _____, and ending the _____ day of _____, _____,

all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said

_____ from the full
(Contractor or Subcontractor)

weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 C.F.R. Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Stat. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. § 3145), and described below:

_____

_____

_____

_____

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, or if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ – in addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ – Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:

NAME AND TITLE	SIGNATURE

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 3729 OF TITLE 31 OF THE UNITED STATES CODE.

DRAFT

AIA® Document A232™ – 2019

General Conditions of the Contract for Construction,
Construction Manager as Adviser Edition

for the following PROJECT:
(Name, and location or address)

Fitness Center Addition at
Harrison High School

THE CONSTRUCTION MANAGER:
(Name, legal status, and address)

School Construction Consultants, Inc.
190 Motor Parkway, Suite 201
Hauppauge, New York 11788

THE OWNER:
(Name, legal status, and address)

Harrison Central School District
50 Union Avenue
Harrison, NY 10528

THE ARCHITECT:
(Name, legal status, and address)

H2M Architects + Engineers
538 Broad Hollow Road, 4th Floor East
Melville, NY 11747

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be used in conjunction with AIA Documents A132™–2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition; B132™–2019, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™–2019, Standard Form of Agreement Between Owner and Construction Manager as Adviser.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents. The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter, the "Agreement"), and consist of the Bidding Documents (including, but not limited to, Invitations to Bid, Instructions to Bidders, sample forms, the Contractor's bid or portions of the addenda relating to bidding requirements), the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect.

§ 1.1.2 The Contract. The Contract Documents form the Contract for Construction (hereinafter, the "Contract"). The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and the Construction Manager or the Construction Manager's consultants, (3) between the Owner and the Architect or the Architect's consultants, (4) between the Contractor and the Construction Manager or the Construction Manager's consultants, (5) between the Owner and a Subcontractor or Sub-subcontractor (6) between the Construction Manager and the Architect, or (7) between any persons or entities other than the Owner and Contractor. The Construction Manager and Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of their duties.

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§ 1.1.3 The Work. The term "Work" means the construction and services required by the Contract Documents, or as reasonably inferable therefrom, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project. The Work includes all of the Contractor's responsibilities as to all labor, parts, supplies, equipment, skill, supervision, transportation services, storage requirements, and other facilities and things necessary, proper or incidental to the carrying out and completion of the terms of the Contract Documents and all other items of cost or value needed to produce, construct, and fully complete the Contractor's Work identified by the Contract Documents.

§ 1.1.4 The Project. The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by other Contractors, and by the Owner's own forces and Separate Contractors.

§ 1.1.5 Contractors. Contractors are persons or entities, other than the Contractor or Separate Contractors, who perform Work under contracts with the Owner that are administered by the Architect and Construction Manager, and include Multiple Prime Contractors.

§ 1.1.6 Separate Contractors. Separate Contractors are persons or entities who perform construction under separate contracts with the Owner not administered by the Architect and Construction Manager.

§ 1.1.7 The Drawings. The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.8 The Specifications. The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.9 Instruments of Service. Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

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§ 1.1.10 Initial Decision Maker. The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.1.11 Project Manual. The Project Manual is a volume assembled for the work that includes the Instructions to Bidders, General Conditions, Supplementary General Conditions, the Specifications, and all Addenda issued prior to execution of the Contract. The Project Manual will additionally include bidding requirements and documents and sample forms.

§ 1.1.12 Miscellaneous Definitions

§ 1.1.12.1 The terms "knowledge," "recognize" and "discover," their respective derivatives and similar terms in the Contract Documents, as used in reference to the Contractor, shall be interpreted to mean that which the Contractor knows (or should know), recognizes (or should recognize) and discovers (or should discover) in exercising the care, skill, and diligence required by the Contract Documents. The expression "reasonably inferable" and similar terms in the Contract Documents shall be interpreted to mean reasonably inferable by a contractor familiar with the Project and exercising care, skill, and diligence required of the Contractor by the Contract Documents.

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§ 1.1.12.2 The term "any" in the Contract Documents shall be interpreted as "any and all" whenever one or more than one item would be applicable for completion of the Work.

§ 1.1.12.3 Except as otherwise explicitly provided, the words "approved" or "approval" shall mean the written approval of the Architect or the Construction Manager or both.

§ 1.1.12.4 "Accepted," "directed," "permitted," "requested," "required," and "selected" are used herein as term connections and unless specifically noted otherwise are to mean "accepted by the Architect," "directed by the Architect," "permitted by the Architect," "requested by the Architect," "required by the Architect," and "selected by the Architect." However, no such implied meaning will be interpreted to extend the Architect's responsibility into the Contractor's areas of construction supervision.

§ 1.1.12.5 The term "as indicated" or "as shown" shall mean "as indicated in the Contract Documents."

§ 1.1.12.6 The term "include" in any form other than "inclusive" is non-limiting and not intended to mean "all inclusive."

§ 1.1.12.7 The terms "furnish" and "furnish all materials," unless specifically noted otherwise, mean "pay for, supply and deliver to the job site all new materials, systems, equipment, product, or other items so specified."

§ 1.1.12.8 The terms "install" and "furnish all labor," unless specifically noted otherwise, mean "pay for, perform all operations connected with installation of Work including unloading new product to be installed, supplying all necessary equipment and rigs to do the Work, test, place in operation and service, and remove all packing material."

§ 1.1.12.9 The term "product" includes materials, systems, equipment, and other items to be incorporated into the Work.

§ 1.1.12.10 The term "provide," unless specifically noted otherwise, means "furnish new, install, connect up, complete, test and place in operation and service."

§ 1.1.12.11 The term "replace" or similar term shall mean "restore," "renew," "make good," "reconstruct," or "as applicable using new product."

§ 1.1.12.12 The terms "manufacturer" or "supplier" mean any person or entity which contracts to furnish materials to a Contractor, Subcontractor, or any Sub-subcontractor for use at the site of the Project.

§ 1.1.12.13 "Wiring" shall be understood to mean wires or cables with conduit, fittings, boxes, etc., installed complete.

§ 1.1.12.14 "Piping" shall be understood to mean all pipes, fittings, nipples, valves and all accessories connected thereto.

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§ 1.1.12.15 The Contract Time is the period of time specified in Article 3 of the Agreement for completion of the Work.

§ 1.1.12.16 Terms not otherwise defined herein shall have the meanings set forth elsewhere in the Contract Documents.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results. It is intended that all plumbing, mechanical, electrical, and other systems will be complete and in proper operation, and that all construction components, whether part of such systems or otherwise, will be complete and in compliance with accepted construction practice upon completion of the Work. Even if items are missing from the Drawings or Specifications, but are normally required for proper operation of plumbing, mechanical, electrical, and other systems, or to complete otherwise incomplete construction, or to meet governing code requirements, they shall be included by the Contractor, unless he sought and received contradictory interpretation or clarification from the Architect.

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§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.1.2 The Contractor and its Subcontractors shall evaluate and satisfy themselves as to the conditions and limitations under which the Work is to be performed, including without limitation (1) location, layout, and nature of the Project site and surrounding areas, (2) existing building and site conditions, (3) anticipated labor supply and costs, (4) availability and cost of materials, tools, equipment, (5) Owner occupancy requirements and constraints, (6) site safety logistics plan and any phased construction plan and (7) other similar issues. The Owner assumes no responsibility or liability for the physical condition or safety of the Project site or any improvements located on the Project site. The Contractor shall be solely responsible for providing a safe place for the performance of the Work. No adjustments will be made in either the Contract Sum or Contract Time for any failure by the Contractor or any Subcontractor to comply with the requirements of this Section 1.2.1.2.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Instructions and other information furnished in the Specifications including, without limitation, items in connection with prefabricated or prefinished items, are not intended to supersede work agreements between employers and employees. Should the Specifications conflict with such work agreements, the work agreements shall be followed, provided such items are provided and finished as specified in the Contract Documents. If necessary, such work shall be performed on the Project site, instead of at the shop, by appropriate labor and in accordance with the requirements of the Drawings and Specifications.

§ 1.2.2.1 The Work on the Project will be separated into individual and separate contracts. It is the intent of these requirements to include all items of Work for a complete Project in the separate contracts. Each Contractor shall be responsible for understanding and knowing under which contract each item of Work is included.

§ 1.2.2.2 Each section or division of the Specifications has been assigned to one of the Prime Contract scopes. Where a section of the Specification is referenced in the contract scope, then any and all items necessary for the proper and normal installation of the item referenced in the Specification section shall be included whether specifically indicated in the Contract Documents or not.

§ 1.2.2.3 The Contractor acknowledges that the coordination requirements and construction schedule of this Project will require close cooperation and coordination between all Contractors on the Project site.

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§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.2.4 The reference of the "Specifications" regarding the division or separation of the work among types of trades or occupations is only for the suggested purpose of coordinating the work of the different trades, etc. but it shall be the Contractor's entire responsibility for the proper coordination and completion of all the Work described in the "Specifications" whether performed by the Contractor or its Subcontractors, if any. It shall be the Contractor's responsibility to settle definitely with each of its Subcontractors the portions of the Work, which each will be required to do and the Owner, Architect and Construction Manager assume no responsibility whatever for any jurisdiction claimed by any of the trades involved in the Work. The Contractor shall provide each item listed, of quality noted and subject to the qualifications noted, and shall perform operations prescribed according to the conditions stated, including specified operations, processes or methods, furnishing all necessary labor, materials, equipment and incidentals required to complete the Work.

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§ 1.2.5 In the event of inconsistencies within or between parts of the Contract Documents or between the Contract Documents and applicable standards, codes and ordinances, the Contractor shall (1) provide the better quality or greater quantity of work or (2) comply with the more stringent requirements; either or both in accordance with the Architect's interpretation. Where the Contractor perceives a conflict, it shall inform the Architect and Owner thereof and request a decision from the Architect, which shall be promptly communicated by the Architect to the Contractor so as not to cause any delay in the performance of the Work. Any Work performed after perceiving the conflict and prior to resolution by the Architect shall be at the Contractor's risk. The terms and provisions of this Section 1.2.5, however, shall not relieve the Contractor of any of the obligations set forth elsewhere herein.

.1 The Contractor shall not scale Drawings. Dimensions on large scale drawings take precedence over dimensions on small scale drawings. The Contractor shall notify the Architect if additional dimensions are needed. The Contractor shall field verify all dimensions.

.2 Before ordering any materials or doing any work, the Contractor and each Subcontractor shall verify measurements at the Project Site and shall be responsible for the correctness of such measurements. The Contractor shall confirm all dimensions by field measuring. No extra charge or compensation will be allowed on account of differences between actual dimensions and the dimensions indicated on the Drawings. Any difference that may be found shall be submitted to the Architect for resolution before proceeding with the Work.

.3 If a minor change in the Work is found necessary due to actual field conditions, the Contractor shall submit detailed drawings of such departure for the approval by the Architect before making the change.

.4 Certain portions of the Specifications are written in condensed outline form and omitted words are to be supplied by inference. Naming of an article or operations shall have the effect of stating "Contractor shall furnish, install and complete" said operation or article unless it is further qualified in the context in which it appears.

.5 When reference is made to specifications of a manufacturer, trade association, governmental agency, reference standard or similar source (such as ASTM, ASA, AISC, ACI, etc.), such is made part of the Drawings and Specifications, having the force and effect as though reproduced therein, and upon entering into the Contract the Contractor acknowledges its familiarity with those pertaining to its Work. Furthermore, all Work mentioned or indicated in the Contract Documents shall be performed by the Contractor as part of the Contract unless it is specifically indicated in the Contract Documents that such work is to be done by others. All Work shall conform to the National Electric Code, New York State Uniform Fire Prevention and Building Code, and amendments thereto, New York State Energy Conservation Construction Code, State Education Department Manual of Planning Standards, New York State Department of Transportation, Office of Engineering, Standard Specification, Construction and Materials, latest edition, Life Safety Code – NFPA, and applicable City and State Building Codes and Authorities having jurisdiction. The date of the reference standard shall be the latest edition at the time of signing the Contract except as specifically indicated otherwise.

.6 The Contract Drawings are intended to show the general arrangement, design, and extent of the Work and are partly diagrammatic. They are not intended to be scaled for any purpose, or to serve as shop drawings. The Contractor and its Subcontractors will cooperate with all other contractors and their respective subcontractors in determining the construction of systems, running of pipe, and locating equipment. The Contractor agrees that the failure to repeat typical details, figures, or notes on all Contract Drawings or other Contract Documents will not be a basis for claims for additional cost or time.

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.7 Any necessary variations in routing or installation shall be made to conform to the intent of the Contract Documents without additional costs. Where there are intersections or obstructions involving ducts, piping, or any other equipment requiring offset of materials, the Contractor acknowledges that it gave particular consideration to clearances in advance of submitting its bid, and that no additional costs for these issues will be considered by the Owner.

.8 If conflicting conditions or interferences develop, the Contractor and its Subcontractors will confer with the other contractors and their respective subcontractors whose work is affected to determine a solution acceptable to all interested parties. The suggested solution shall be submitted to the Architect for comment and, if necessary, written approval.

.9 The Contract Documents intend a first class finished product of such character and quality as described in and reasonably inferred from the Contract Documents. The Contractor will perform its Work to be complete and operable, fitting with the work of other contractors and the Owner, and in compliance with best construction practices and the ordinances, codes, and regulations of all bodies or persons having governmental or regulatory authority over the Contractor and its Work.

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§ 1.2.6 Execution of the Contract by the Contractor is a representation that the Contractor has carefully examined the Contract Documents and the Project site, and represents that the Contractor is thoroughly familiar with the nature and location of the Work, the Project site, the specific conditions under which the Work is to be performed, and all matters which may in any way affect the Work or its performance. The Contractor further represents that as a result of such examinations and investigations, the Contractor thoroughly understands the Contract Documents and their intent and purpose, and is familiar with all applicable codes, ordinances, laws, regulations, and rules as they apply to the Work, and that the Contractor will abide by same. Claims for additional time or additional compensation as a result of the Contractor's failure to follow the foregoing procedure and to familiarize itself with all conditions and the Contract Documents will not be permitted.

§ 1.2.6.1 The Contractor certifies that it is experienced and familiar with the requirements and conditions imposed during the construction of similar work in the area. This includes, but is not limited to, "out of sequence" or "come back" work for the removal of plant, equipment, temporary wiring or plumbing, etc. This "out of sequence" work may also include phasing of construction activities to accommodate the installation of the Work at various locations and orderly fashion and the completion of Work at various locations or levels at various times. This "phasing," "out of sequence," or "come back" work shall be done at no cost to other Contractors, the Owner or Architect.

§ 1.2.6.2 The Contractor, and all Subcontractors, shall refer to all of the Drawings, including those showing the work of others performing work in connection with the Project, including but not limited to the other contractors, and to all of the Divisions of the Project Manual, and shall perform all work reasonably inferable therefrom as being necessary to produce the indicated results.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity, the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Drawings, Specifications and other documents prepared by the Architect are instruments of the Architect's services through which the Contractor's Work is to be performed. The Contractor, Subcontractors, sub-subcontractors, and suppliers shall not own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Drawings, Specifications and other documents prepared by the Architect provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Drawings, Specifications and other

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documents prepared by the Architect. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Drawings, Specifications and other documents prepared by the Architect on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.5.3 The Contractor may not reproduce the Contract Documents in whole or part for use as shop drawing backgrounds without the prior written consent of the Architect. If consent is given, the Architect will determine the extent that the Contract Documents may be used in the preparation of shop drawings.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, all notices to be given hereunder shall be in writing and may be given, served, or made (1) by depositing the same for first class mail delivery in the United Stated mail addressed to the authorized representative of the party to be notified; (2) by depositing the same in the United Stated mail addressed to the authorized representative of the party to be notified, postpaid and registered or certified with return receipt requested; (3) by depositing the same for overnight delivery (prepaid by or billed to the party giving notice) with the United States Postal Service or other nationally recognized overnight delivery service addressed to the authorized representative of the party to be notified; or (4) by delivering the same in person to the said authorized representative of such party. Notice deposited in the mail by certified mail or overnight delivery in accordance with the provisions hereof shall be effective from and after the fourth (4th) day next following the date postmarked on the envelope containing such notice, or when actually received, whichever is earlier. All notices to be given to the parties hereto shall be sent to or made at the addresses set forth in the Agreement. By giving the other parties at least seven (7) days' written notice thereof, the parties hereto shall have the right to change their respective addresses and specify as their respective addresses for the purposes hereof any other address in the United States of America.

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§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization except for those matters that require the approval of the Owner's Board of Education. Except as otherwise provided in Section 4.2.1, the Construction Manager and the Architect do not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights.

§ 2.1.3 The Owner, Architect or Construction Manager shall not supervise, direct or have control or authority over, nor be responsible for, the Contractor's means, methods, techniques, sequences or procedures of construction or the safety precautions and programs incident thereto, or for any failure of the Contractor to comply with laws and

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regulations applicable to the furnishing or performance of the Work. The Owner, Architect and Construction Manager shall not be responsible for the Contractor's failure to perform or furnish the Work in accordance with the Contract Documents.

§ 2.2 Evidence of the Owner's Financial Arrangements – Intentionally Omitted.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 All permits and fees, approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities are the responsibility of the Contractor under the Contract Documents with the exception of the building permit, which the Owner will obtain from the New York State Education Department. The Contractor shall furnish the Construction Manager with original copies of all permits prior to the commencement of the work, and shall prominently display a copy of all permits at a location approved by the Construction Manager.

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§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 The Owner shall retain a construction manager adviser lawfully practicing construction management in the jurisdiction where the Project is located. That person or entity is identified as the Construction Manager in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.4 If the employment of the Construction Manager or Architect terminates, the Owner shall employ a successor construction manager or architect whose status under the Contract Documents shall be that of the Construction Manager or Architect, respectively.

§ 2.3.5 The Owner shall make available for inspection, upon request, that field survey or testing information of existing conditions that is known to be available and that is held by the Owner at its offices. Such records and documents are not Contract Documents, and the Owner makes no representation as to their accuracy or completeness. Notwithstanding the foregoing, information furnished by the Owner in the form of surveys, subsurface investigation reports, soil borings, and other material of a similar nature, is for general information only and is not a guarantee of the completeness or accuracy of such information, unless specifically noted otherwise herein. The Contractor shall verify all existing grades, conditions, and dimensions of existing physical conditions and structures and shall report any inconsistencies in writing to the Architect. The Contractor shall establish all lines and levels required to execute the Work and shall bear all costs involved, and shall be responsible for their accuracy and maintenance.

§ 2.3.6 Intentionally omitted.

§ 2.3.7 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one set of Contract Drawings and the Project Manual for use during construction for its own use and for purposes of making reproductions pursuant to Section 1.5.2. The Owner shall furnish additional sets upon the Contractor's written request. Such additional sets will be provided at the cost of printing, postage and handling. Partial sets will not be provided. Subcontractors and other entities desiring copies of Drawings and the Project Manual will be provided sets at the cost of printing, postage and handling.

§ 2.3.8 The Owner shall endeavor to forward all communications to the Contractor through the Construction Manager. Other communication shall be made as set forth in Section 4.2.6.

§ 2.4 Owner's Right to Stop the Work

If the Contractor (1) fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2, or (2) fails to carry out Work in accordance with the Contract Documents as determined by the Owner, Architect or Construction Manager, or (3) fails or refuses to provide a sufficient amount of properly supervised and coordinated labor, materials, or equipment so as to be able to complete the Work within the Contract Time, or (4) fails to remove and discharge (within seven (7) days) any lien filed upon Owner's property by anyone claiming by, through, or under the Contractor, or (5) fails to perform the Work in a safe manner and in compliance with all applicable health and safety requirements and the Contractor's site specific health and safety plan, or (6) disregards the instructions of the Architect, Owner or Construction Manager, as determined by the Owner, Architect or Construction Manager, the Owner may issue a written order to the Contractor to stop the Work, or any portion

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thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity. Such order or stoppage by the Owner shall not constitute grounds for termination by the Contractor under Article 14 and shall not be a basis for an extension of the Contract Time under Section 8.3 or Article 15.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents (including but not limited to all applicable health and safety requirements) and fails within a three (3) work day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may after such three (3) work day period, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order or Construction Change Directive shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including the Owner's expenses and compensation for the Construction Manager's and Architect's and their respective consultants' additional services and other expenses made necessary by such default, neglect or failure. Such Change Order or Construction Change Directive shall be deemed to have been executed by the Contractor, whether or not actually signed by the Contractor. Such action by the Owner and amounts charged to the Contractor shall be equally binding upon the Contractor's performance and payment bond surety. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

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§ 2.5.1 Where the Contractor's default and/or neglect to carry out its Work in accordance with the Contract Documents threatens the health, safety and/or welfare of the occupants of the Owner's facilities and/or threatens the structural integrity and/or preservation of the Owner's facilities, the Owner may proceed to carry out the Contractor's Work upon twenty-four (24) hours' notice of its intention to do so to the Contractor. In such case an appropriate Change Order or Construction Change Directive shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies and defaults, including the Owner's expenses and compensation for the Architect's and its respective consultants' additional services and other expenses made necessary by such default, neglect or failure.

§ 2.6 Extent of Owner's Rights

The rights stated in this Article 2 and elsewhere in the Contract Documents are cumulative and not in limitation of any rights of the Owner (1) granted in the Contract Documents, (2) at law or (3) in equity.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The plural term "Multiple Prime Contractors" refers to persons or entities who perform construction under contracts with the Owner that are administered by the Construction Manager. The term does not include the Owner's own forces, including persons or entities under separate contracts not administered by the Construction Manager.

§ 3.1.3 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.4 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Construction Manager or Architect in their administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor. The Contractor shall maintain complete inspection records and test date to ensure the quality of the Work is in strict compliance with the requirements of the Contract Documents.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

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§ 3.2.1.1 The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Owner pursuant to Section 2.3.5 and shall at once report in writing to the Construction Manager and the Architect errors, inconsistencies or omissions discovered. The Contractor shall not be liable to the Owner, the Construction Manager or the Architect for damage resulting from errors, inconsistencies or omissions in the Contract Documents unless the Contractor knew or reasonably should have known of such error, inconsistency or omission and failed to report it as required by this section to the Construction Manager and the Architect. If the Contractor performs any construction activity knowing it involves, or reasonably should have known it involves, a recognized error, inconsistency or omission in the Contract Documents without such notice to the Construction Manager and the Architect, the Contractor shall assume full responsibility for such performance and shall bear sole responsibility for the costs for correction.

§ 3.2.1.2 The obligations of the Contractor under Section 3.2.1.1 and this Section 3.2.1.2 are for the purpose of facilitating construction by the Contractor and are not for the purpose of imposing an affirmative obligation on the Contractor to discover errors, omissions, or inconsistencies in the design information in the Contract Documents. The Contractor's review of the Contract Documents is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically so provided in the Contract Documents.

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§ 3.2.1.3 Failure by the Contractor to promptly report any errors, inconsistencies, or omissions in the Contract Documents discovered by the Contractor, or which the Contractor reasonably should have known or discovered, shall constitute a waiver by the Contractor of any claim that otherwise might result in a change in the Contract Sum or Contract Time.

§ 3.2.2 The Contractor shall be presumed to have performed a detailed investigation of the Project site(s) to consider fully all conditions that may have a bearing on the Work and to have accounted for these conditions in its proposal. The Contractor is deemed to be a qualified expert in the systems and construction requirements of the Work of its Contract. The Contractor hereby specifically acknowledges and declares that the Contract Documents are full and complete, are sufficient to have enabled it to determine the cost of the Work, and that the Drawings, the Specifications, and all Addenda are sufficient to enable the Contractor to construct the Work outlined therein in accordance with applicable laws, statutes, building codes, and regulations, and otherwise to fulfill all of its obligations under the Contract Documents. The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies, or omissions discovered shall be reported to the Construction Manager and the Architect at once. The exactness of grades, elevations, dimensions, or locations given on any Drawings issued by the Architect, or the work installed by other Contractors, is not guaranteed by the Architect, Construction Manager, or the Owner. The Contractor shall, therefore, satisfy itself as to the accuracy of all grades, elevations, dimensions, and locations. In all cases of interconnection of its Work with existing or other work, the Contractor shall verify at the site all dimensions relating to such existing or other work. Any errors due to the Contractor's failure to so verify all such grades, elevations, dimensions, or locations shall be promptly rectified by the Contractor without any additional cost to the Owner. Except as to any reported errors, inconsistencies or omissions, and except as to concealed or unknown conditions, by executing the Agreement, the Contractor represents to the Owner, Construction Manager, and the Architect that the Work required by the Contract Documents, including, without limitation, all construction details, construction means, methods, procedure and techniques necessary to perform the Work, use of materials, selection of equipment and requirements of product manufacturers are consistent with: (1) good and sound practices within the construction industry; (2) generally prevailing and accepted industry standards applicable to Work; (3) the requirements of any warranties applicable to the Work; and (4) all laws, ordinances, regulations, rules and orders which bear upon the Contractor's performance of the Work.

§ 3.2.3 The Contractor shall perform the Work in accordance with the Contract Documents and submittals approved pursuant to Section 3.12.

§ 3.2.4 The Contractor may submit Requests for Information ("RFI") to the Architect, through the Construction Manager, to help facilitate the Contractor's performance of the Work. Prior to submitting each RFI, the Contractor shall first carefully study and compare the Contract Documents, field conditions, other Owner provided information, Contractor-prepared Coordination Drawings, and prior Project correspondence and documentation to determine that the information to be requested is not reasonably obtainable from such sources. The Contractor shall submit each RFI sufficiently in advance of the date by which such information is required in order to allow the Architect sufficient time to permit adequate review and response and to permit Contractor compliance with the latest

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construction schedule. The Contractor shall reimburse the Owner amounts charged by the Architect for RFI responses that in the opinion of the Architect were available from a careful review of the Contract Documents, field conditions, other Owner provided information, Contractor-prepared Coordination Drawings, and prior Project correspondence and documentation.

§ 3.2.4.1 RFIs are for requests on clarifications or questions on contract drawings and specifications, not contract terms, scheduling items, or general correspondence, nor, as a means to describe or request approval of alternate construction means, methods or concepts or substitution or materials, systems means and methods. The Contractor shall fill all RFIs out in accordance with the provisions of the Project Manual. Neither the Architect nor the Construction Manager shall fill said forms out on the Contractor's behalf.

§ 3.2.5 If the Contractor, during the progress of the Work, discovers any discrepancies between the Drawings and the Specifications, errors or omissions on the Drawings, or any discrepancies between physical conditions of the Work and the Drawings, and has notified the Architect and Construction Manager in writing under Section 3.2.1, no deviations from the Contract Documents shall be performed by the Contractor until it receives approval in writing from the Architect through the Construction Manager. Any Work performed after such discovery without the approval of the Architect shall be at the Contractor's sole risk and expense.

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§ 3.2.6 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Construction Manager and the Architect any nonconformity discovered by or made known to the Contractor as a RFI submitted to the Architect.

§ 3.2.7 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or RFIs pursuant to Sections 3.2.1, 3.2.2, 3.2.4, 3.2.5 or 3.2.6, the Contractor shall make a Claim as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.1, 3.2.2, 3.2.4, 3.2.5 or 3.2.6, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or the Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.2.8 The Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of Owner. The Contractor shall report to the Construction Manager and Architect whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

§ 3.2.8.1 The Contractor shall be required to establish centerlines, elevations and location of his work when it is required for the benefit of other Contractors needing the information to coordinate location of their work.

§ 3.2.9 Whenever the Drawings show existing or other construction not required as part of the Contract Work, it is understood that it is so shown as a matter of information and that the Owner, while believing such information to be substantially correct, assumes no responsibility thereof. The Contractor shall make itself familiar with all conditions affecting the nature and manner of conducting the Work.

§ 3.2.10 The Architect may require that the Work be suspended at any time when location and limit marks established by the Contractor are not reasonably adequate to permit checking completed Work or the Work in progress.

§ 3.2.11 The Contractor and each Subcontractor shall evaluate and satisfy themselves as to the conditions and limitations under which the Work is to be performed, including, without limitation, (1) the location, condition, layout and nature of the Project site and surrounding areas, (2) generally prevailing climatic conditions, (3) anticipated labor supply and costs, (4) availability and cost of materials, tools and equipment, and (5) other similar issues. Notwithstanding any other provision herein, the Owner, the Architect and Construction Manager assume no responsibility or liability for the physical condition or safety of the Project site or any improvements located on the Project site. The Contractor shall be solely responsible for safety and providing a safe place for the performance of

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the Work. The Owner assumed no responsibility for any erroneous conclusions or interpretations made by the Contractor based on information made available by the Owner. No adjustments will be made in either the Contract Sum or Contract Time for any failure by the Contractor or any Subcontractor to comply with the requirements of this section.

§ 3.2.12 Claims for additional compensation or extension of time due to the Contractor's failure to familiarize itself with the conditions at the site will not be allowed.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention, and shall complete the Work in a good and workmanlike manner in accordance with the Contract Documents. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work subject to the coordination of the Construction Manager. Where the Drawings or Project Manual make reference to particular construction means, methods, techniques, sequences or procedures or indicate or imply that such are to be used in connection with the Contractor's Work, such reference is intended only to indicate that the Contractor's Work is to produce at least the quality of the work implied by the operations described, but the actual determination as to whether or not the described operations may be safely or suitably employed in the performance of the Contractor's Work shall be the sole responsibility of the Contractor. All loss, damage, liability, or cost of correcting defective Work arising from the employment of a specific construction means, method, technique, sequence or procedure shall be borne solely by the Contractor.

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§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor, the Contractor's employees, Subcontractors, suppliers, and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors, Suppliers or Sub-subcontractors, and for any damages, losses, costs and expenses resulting from such acts or omissions, including but not limited to reasonable attorneys' fees.

§ 3.3.3 The Contractor shall be responsible for coordinating the work of its own forces and the work of Subcontractors engaged by it to perform the Work of the Project on its behalf. The Contractor shall supply to its own work forces, and Subcontractors engaged by it to perform portions of its Work, copies of the Drawings and Project Manuals for the work to be performed by such individuals/entities on its behalf. The Contractor shall be responsible to the Owner for the acts and/or omissions of the Contractor, the Contractor's employees, the Contractor's Subcontractors, the Contractor's material suppliers, and/or their respective agents and employees, and any other persons performing portions of the Work on behalf of the Contractor.

§ 3.3.3.1 The Contractor shall coordinate its operations and cooperate with those of other Contractors performing work on the Project or site thereof to ensure efficient and orderly installation of each part of the Work. Cooperation will be required in the arrangement for the storage of materials and in the detailed execution of the Work. The Contractor shall remain informed of the progress and the detail work of other Contractors and shall notify the Construction Manager immediately of lack of progress or defective workmanship on the part of other Contractors, where such delay or such defective workmanship will interfere with Contractor's own operations. Failure of the Contractor to keep informed of the work progressing on the site or to give notice of lack of progress or defective workmanship by others shall be construed as acceptance of the progress of work and coordination with Contractor's own Work.

§ 3.3.3.2 The Contractor's obligations under the Contract Documents shall include, without limitation, the following:

- **.1** Review of all specified construction and installation procedures with its employees and Subcontractors, including, without limitation, those recommended by manufacturers, prior to the commencement of the relevant portion of the Work to be performed.
- **.2** Advising the Construction Manager and the Architect:
  - **.1** if a specified procedure deviates from best construction practice;
  - **.2** if following a procedure will affect any warranties, including the Contractor's general warranty; or
  - **.3** of any objections the Contractor may have to a procedure.
- **.3** Proposing alternative procedures, as appropriate, which procedures shall be covered by the Contractor's warranty as described in Section 3.5 hereof.
- **.4** The Contractor shall be responsible for organizing and conducting pre-installation conferences and must coordinate such conferences with the Architect and the Construction Manager.

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§ 3.3.3.3 The Contractor and its Subcontractors working on the Project shall attend a preconstruction conference(s) or meeting(s) as deemed necessary by the Construction Manager to coordinate all Work (e.g., demolition, installation, etc.), and as required by the Project Manual.

§ 3.3.4 Where equipment lines, piping, ductwork, or conduit are shown diagrammatically, the Contractor shall be responsible for the coordination and orderly arrangement of the various lines of piping and conduit included in the Work of its Contract. The Contractor shall coordinate the work of its Subcontractors and prevent all interferences between or among equipment, lines of piping, and architectural features, and avoid any unsightly arrangements in exposed areas. This Section shall not be construed as limiting any obligation of the Contractor under any other provision of the Contract Documents.

§ 3.3.5 The Contractor shall be responsible for inspection of portions of the Project already performed to determine that such portions are in proper condition to receive subsequent Work.

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§ 3.3.6 The Contractor, its employees and Subcontractors, shall be subject to such rules and regulations for the conduct of Work as the Owner may establish, including but not limited to, the Construction Rules and Regulations set forth in Section 3.13.4. The Contractor shall be responsible for the enforcement among its employees and Subcontractors of the Owner's instructions and restrictions.

§ 3.3.7 The Contractor shall inspect all materials as delivered to the Project site and shall reject any materials that will not conform with the requirements of the Contract Documents when properly installed.

§ 3.3.8 The Contractor shall be responsible for and coordinate any and all inspections required by any governmental body having jurisdiction over the Project. Failure to obtain any permits, licenses or other approvals because of the failure of the Contractor to conform to this requirement shall not extend the Contract time, and the Contractor shall not be entitled to any increase in the Contract Sum therefore. In addition, any additional costs and expenses of any nature incurred by the Owner as a result of the Contractor's failure to conform to this requirement shall constitute a charge against the Contractor's Contract.

§ 3.3.9 Shut Downs: Such work as connections to existing sewers, plumbing, heating, and electrical systems shall be coordinated at a time agreeable to the Owner, the Architect, and the Construction Manager, and shall be determined and agreed to well in advance of the actual performance of such work so as to interfere as little as possible with the operation and use of the Owner's existing facilities. Shut downs must be coordinated through the Construction Manager. The continued uninterrupted operation of all facilities of the Owner's buildings is essential. If any existing facilities must be interrupted, the Contractor for the Work shall provide all necessary temporary facilities and connections necessary for maintaining these existing facilities at no increase in the Contract Sum except as otherwise specified. No mechanical, heating, plumbing, sprinkler, or electric service shall be interrupted at any time except as approved in advance by the Owner or when the buildings are not occupied and shall be coordinated with the Owner, as well as the Construction Manager. All communication systems must be maintained without interruption. As much related work as possible shall be performed prior to shut downs, so as to minimize the period of shut down. All material, equipment, and manpower necessary in the performance of a shutdown shall be on site prior to interruption of service.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor (at applicable prevailing wage rates), materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. The Contractor shall work continuously and expeditiously through completion of the Work. Time is of the essence.

§ 3.4.1.1 A shortage of labor in the industry shall not be accepted as an excuse for not properly manning the Project at each site.

§ 3.4.1.2 The Contractor shall be responsible for the care and protection of all equipment and materials for its Work on the Project, including equipment and material furnished by the Owner.

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§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the written consent of the Owner, after evaluation by the Architect, in consultation with the Construction Manager, and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them, or persons who within the last two weeks (a) having been exposed to someone having been diagnosed with a COVID-19 infection; or (b) having had a persistent cough, shortness of breath, or a fever of 100.4 or higher. The Owner reserves the right to object to the Contractor's use of persons who appear unfit or not skilled in the tasks assigned to them. Should any disorderly, incompetent, unfit, unskilled or objectionable person be hired or employed by the Contractor, upon or about the premises of the Owner, for any purpose or in any capacity, they shall, upon request of the Owner, be removed from the Project and not again be assigned thereon without the written permission of the Owner.

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§ 3.4.3.1 In addition to all other safety requirements, the Contractor shall provide suitable and a sufficient number of safety related facilities and personal protective equipment (PPE) at the site related to protection against the spread of COVID-19, including but not limited to handwashing stations, hand sanitizer, gloves, masks, faceshields, and other equipment as the Owner may reasonably request. Notwithstanding the foregoing, nothing herein shall be construed to delegate or relieve Contractor from having sole and exclusive responsibility for all worksite safety.

§ 3.4.4 All mechanics employed on the Project shall be persons skilled in that work which they are to perform. Work will not be approved if it does not meet the quality of workmanship as called for in the Contract Documents. If this quality of workmanship is not exactly defined herein, it shall be assumed to be the best standards of workmanship for the trade. Employees of the Contractor or its Subcontractors whose work is unsatisfactory to the Owner, Construction Manager or Architect, or considered by them to be unskilled or otherwise objectionable, will be immediately dismissed from the Project upon notice from the Construction Manager. Those dismissed employees shall be immediately replaced by the Contractor so as not to delay progress of the Work and at no additional cost to the Owner.

§ 3.4.5 On receipt of the signed Contract, the Contractor will be expected to place firm orders with vendors for needed materials, including Subcontractors and major material suppliers. If deemed necessary to assure delivery of materials at times needed, the Contractor may accept delivery of such materials at any time, and may include the cost of such materials in its next monthly Application for Payment, provided such materials have actually been delivered to Contractor and properly stored by it with approval or under direction of the Architect and the Construction Manager either at the Project site or in an approved storage shed or warehouse, as provided elsewhere in these General Conditions.

§ 3.4.5.1 To the fullest extent possible, the Contractor shall provide products of the same kind, from a single source. When two or more items of same material or equipment are required (pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in the work, except as otherwise indicated. The Contractor shall provide products which are compatible within systems and other connected items. If Contractor is given option of selecting between two or more products for use on the Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

§ 3.4.5.2 The Contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors. If a dispute arises between the Contractor and other contractors over concurrently selectable but incompatible products, the Architect will determine which products shall be used.

§ 3.4.5.3 With respect to sitework materials, all products submitted for use and incorporated into the Project shall be on the Approved List of Materials and Equipment published by the NYSDOT Materials Bureau, most recent edition.

§ 3.4.5.4 When required, off-site storage shall be the responsibility of the Contractor. If materials are stored off site, the Contractor shall furnish proof of title by Owner and provide a certificate of insurance demonstrating adequate insurance coverage.

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§ 3.4.5.5 The Contractor shall deliver all materials at such times as will ensure speedy and uninterrupted progress of the Work.

§ 3.4.6 The Contractor warrants that it has good title to all materials used by it in, on or in connection with the Work. No materials or supplies shall be purchased by the Contractor or any of its Subcontractors that are subject to any chattel mortgage, conditional sale or other agreement by which an interest is retained by the seller.

§ 3.4.7 The Contractor shall make every reasonable effort to avoid labor disputes and to insulate the Owner, Architect and Construction Manager from the effects of labor disputes should any arise. There shall be no strikes, picketing, work stoppages, slowdowns or other disruptive activity at the Project for any reason by anyone employed or engaged by the Contractor to perform its portion of the Work. There shall be no lockout at the Project by the Contractor. The Contractor shall be responsible for providing the manpower required to proceed with the Work under any circumstance. For the purposes of this Section, every reasonable effort shall include, but not necessarily be limited to:

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.1 make all necessary arrangements to reconcile, without delay, damage or cost to the Owner and without recourse to the Architect, the Construction Manager or the Owner, any conflict between its Agreement with the Owner and any agreements or regulations of any kind at any time in force among members or councils which regulate or distinguish what activities shall not be included in the work of any particular trade;

.2 requiring employees, Subcontractors, suppliers and others to use reserve gates which shall be established for the Project;

.3 rearranging work schedules for the Contractor's Work or the work of its Subcontractors; and

.4 including in Contractor's agreements with its Subcontractors the right to fully implement all provisions of this Section.

§ 3.4.7.5 In case the progress of the Work is effected by any undue delay in furnishing or installing any items or materials or equipment required pursuant to the Contract because of a conflict involving any such labor agreement or regulation, the Owner may require that other material or equipment of equal kind and quality be provided pursuant to a Change Order or Construction Change Directive but in no case shall the amount of such change be charged by the Contractor to the Owner as an additional cost to perform the Work.

§ 3.4.7.5.1 No extension of the Contract Time shall be granted for delays caused by labor or material disputes.

§ 3.4.7.5.2 Should it become necessary to create a separate entrance for a Contractor involved in a dispute, all costs associated with creating that entrance shall be borne by the Contractor involved in the dispute. Such costs shall include, but not limited to signage, fencing, temporary roads and security personnel as deemed necessary by the Owner for the safety of the occupants of the site.

§ 3.4.7.6 The Contractor shall ensure that its Work continues uninterrupted during the pendency of a labor dispute.

§ 3.4.7.7 The Contractor shall be liable to the Owner for all damages suffered by the Owner occurring as a result of work stoppages, slowdowns, disputes or strikes arising from the labor practices of the Contractor or its Subcontractors, Suppliers or Sub-subcontractors.

§ 3.4.8 The Contractor and its Subcontractors employed upon the Work shall abide by and conform with all labor laws and to all other laws, ordinances, and legal requirements now or hereafter applicable to the Work or the construction area.

§ 3.4.9 The Contractor and its Subcontractors shall be responsible for protection of the Work, the work of Separate and other Contractors, and existing construction, both on and off the site, and in the event of damage, shall restore the same to the original condition at no additional cost to the Owner.

§ 3.4.10 If the Work is to be performed by trade unions, the Contractor shall, with the consent of the Owner and the Architect, which shall not be unreasonably withheld, make all necessary arrangements to reconcile, without delay, damage, or cost to the Owner, any conflict between the Contract Documents and any agreements or regulations of any kind, at any time in force among members or councils that regulate or distinguish what activities are included in the work of any particular trade.

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§ 3.4.11 No new asbestos containing building materials shall be used in construction. No materials containing asbestos in any form shall be used in, on, or around the Owner's buildings**.**

§ 3.4.12 Equivalents and Substitutions

§ 3.4.12.1 Equivalents. In the Specifications, one or more kinds, types, brands, or manufacturers or materials are regarded as the required standard of quality and are presumed to be equal. The Contractor may select one of these items or, if the Contractor desires to use any kind type, brand, or manufacturer or material other than those named in the Specifications, it shall indicate in writing, and prior to award of the Contract, what kind, type, brand or manufacturer is included in the base bid for the specified item. The Contractor shall follow the submission requirements for equivalents as provided in Section 3.4.12.2 and the Project Manual. Any proposed equivalent shall not be purchased or installed by the Contractor without the Architect's review process having been completed and the product accepted by written notification.

§ 3.4.12.2 Substitutions. If the Contractor desires to substitute any kind, type, brand, or manufacturer of material other than those named in the Specifications, the Contractor shall request in writing that it be permitted to make a substitution for the specified manufacturer or materials and shall indicate the following:

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.1 For which specified material or equipment the request for substitution is being made;

.2 What kind, type, brand, or manufacturer is sought to be substituted for the specified items;

.3 Written documentation evidencing that the substituted material or equipment meets or exceeds the specifications for materials and/or equipment set forth in the Project Manual. Such documentation shall include, but not limited to, a full explanation of the proposed substitution, together with a submittal of all supporting data including technical information, catalog cuts, warranties, test results, installation instructions, operating procedures, significant qualities of proposed substitution (e.g. performance, weight, size, durability and visual effects), and other like information necessary for a complete evaluation of the substitution. Additionally, the Contractor shall provide material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated. All such data shall be provided to the Architect and Owner at the Contractor's sole expense. The Contractor's written explanation shall also include a list of reasons the substitution is advantageous and necessary, including the benefits to the Owner and the Project in the event the substitution is acceptable. The Contractor shall also submit to the Architect information describing in specific detail how the proposed substituted product differs from the quality and performance required by the base specifications, and such other information as may be required by the Owner or the Architect;

.4 Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution;

.5 Samples, where applicable or requested;

.6 Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery; and

.7 Detailed comparison of the difference in cost between the specified product and the proposed substitution including any and all costs associated with changes or modifications needed to other parts of the work and to construction performed by the Owner and/or separate Contractors that will be necessary to accommodate proposed substitution. In the event the substation is accepted, the Contractor proposing the use of the substitution shall bear all costs associated with said changes or modifications.

§ 3.4.12.3 By making said requests in conformance with procedures established herein and elsewhere in the Project Manual, the Contractor:

.1 Represents that a representative of it has personally investigated the proposed substitute product and has determined that it is equal to or superior in all respects to that specified;

.2 Represents that the warranty for the substitution will be the same, or greater than, that applicable to the specified product;

.3 Certifies that the cost data is complete and includes all related costs under the Contract, including professional services necessary and/or required for the Architect and/or its consultants to implement said substitution and waives any and all claims for additional costs related to the substitution which subsequently become apparent;

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.4 Represents that it will coordinate the installation of the accepted substitute, making all such changes to the Drawings effected by the change, including but not limited to the electrical, plumbing, site work and heating and ventilating Specifications as may be required for the Work to be complete in all respects; and

.5 An affidavit stating that (1) the proposed substitution conforms and meets all the requirements of the pertinent Specifications and the requirements shown on the Drawings and (2) the Contractor accepts the warranty and correction obligations in connection with the proposed substitution as if originally specified by the Architect; and the proposed substitution will have no effect on the Contractor's construction schedule.

§ 3.4.12.4 Proposals for substitutions shall be submitted in triplicate to the Architect in sufficient time to allow the Architect no less than seven (7) working days after receipt of a Notice to Proceed or award of the Contract, whichever is earlier, for review.

§ 3.4.12.5 No substitutions will be considered or allowed without the Contractor's submittal of complete substantiating data and information as stated hereinbefore.

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§ 3.4.12.6 All proposed substitutions shall be submitted to the Architect within twenty-one (21) days of the Award of the Contract to the Contractor. (This Section 3.4.12.6 shall not apply to equivalents.)

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner, Construction Manager, and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform with the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements, including substitutions not properly approved and authorized, shall be considered defective. This warranty shall include all parts and labor both on and off the Project site, together with all necessary transportation and shipping charges. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. All warranties and guarantees specifically called for by the Specifications shall expressly run to the benefit of the Owner. If required by the Architect or Construction Manager, the Contractor shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with instructions of the applicable supplier, except as otherwise provided in the Contract Documents. The Contractor shall perform the Work in strict accordance with the Contract Documents and best industry practices. All materials are to be new, unless specified otherwise. The Contractor, at its expense, shall upon demand by the Owner, Architect or Construction Manager remove and replace materials not meeting Specifications or materials failing to perform as represented or warranted by the manufacturer, regardless of whether incorporated into the Work. The Contractor shall promptly replace or correct any work or materials that the Owner, Construction Manager or Architect rejects as failing to conform to the requirements of the Contract Documents. The foregoing warranty obligations are not limited by the provisions of Article 12, and are in addition to and not in limitation of any other warranty set forth in the Contract Documents or otherwise prescribed by law.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4. The Contractor shall assign to the Owner at the time of final completion of the Work any and all manufacturer's warranties relating to materials and labor used in the Work and further agrees to perform the Work in such manner so as to preserve any and all such manufacturer's warranties. The Contractor shall fully cooperate with the Owner in the event the Owner pursues remedies under any warranties assigned to the Owner. The Contractor acknowledges that its obligations to the Owner under this subparagraph are joint and several with its Subcontractors, suppliers, and material or equipment manufacturers of all materials and equipment supplied on account of the Work.

§ 3.5.3 No warranties or guarantees by the Contractor will deprive the Owner of any cause of action, right, or remedy otherwise available for breach of any of the provisions of the Contract Documents. Neither final payment nor provision in the Contract Documents nor partial or entire occupancy of premises by Owner shall constitute an acceptance of Work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any express warranties or responsibilities for faulty or defective materials or workmanship.

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§ 3.5.3.1 The Contractor shall deliver to the Owner upon completion of all work under its Contract, its written guarantee made out to the Owner in a form acceptable to the Owner, guaranteeing (and it does so guarantee) all of the Work under the Contract to be free from faulty materials, and free from improper workmanship, and guarantees against injury from proper and usual wear and aging.

§ 3.5.4 All required maintenance shall be the Contractor's responsibility until the Owner has accepted the Project as complete, all required maintenance and user's manuals have been turned over to the Owner, and the Owner's designated personnel have been instructed in the maintenance and operation of all applicable materials. This maintenance shall include a complete turnover procedure at the time of completion, including complete cleaning, testing and adjustment. The Contractor shall keep records of all such maintenance performed as required by this Section, including work performed and times and dates on which it was performed. These records shall be turned over to the Owner at closeout.

§ 3.5.5 The Contractor shall in case of work performed by its Subcontractors, and where guarantees are required, secure warranties from Subcontractors and deliver copies of same to the Construction Manager countersigned by the Contractor.

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§ 3.6 Taxes

Except as otherwise specified, the Contractor shall pay sales, consumer, use and similar taxes for the Work or portions thereof provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.6.1 The Owner is exempt from payment of federal, state, and local sales and compensation use taxes on all supplies and materials incorporated into and becoming an integral component part of the structures, buildings, or real property pursuant to this Contract. Such taxes are therefore not to be included in the Contractor's bid or the Contract Sum. The Owner shall deliver to the Contractor the appropriate exemption certificate required to be supplied by the Owner, and the Contractor and its Subcontractors and materialmen shall be solely responsible for obtaining and delivering any and all exemption or other certificates and for furnishing a Contractor Exempt Purchase Certificate or other appropriate certificates to all persons, firms, or corporations from whom they purchase supplies, materials, and equipment for the performance of the Work.

§ 3.6.1.1 The Contractor's attention is called to fact that materials not actually incorporated into Work will not be exempt from payment of sales or compensating use taxes, and the Contractor and its Subcontractor shall be responsible for and shall pay any and all applicable taxes. This will apply to such things as:

- **.1** construction machinery and equipment including rentals or repair parts;
- **.2** The Contractor's office supplies;
- **.3** The Contractor's supplies, tools and miscellaneous equipment including forms, materials and scaffolding (whether purchased or rented);
- **.4** temporary heat;
- **.5** telephone or electric services; and
- **.6** any other items purchased or rented by the Contractor for the Contractor's use in performing its Work and not incorporated into realty.

§ 3.6.2 The Contractor accepts full and exclusive liability for payment of any and all contributions, assessments or taxes for unemployment insurance or old age insurance, or annuities now or hereafter imposed by the government of the United States, or by the government of any city, county or state of United States, which are measured by salaries or other remuneration paid to persons employed by the Contractor or any Subcontractor for Work performed under this Contract.

§ 3.7 Permits, Fees, Notices, and Compliance with Laws

§ 3.7.1 The Owner shall secure a building permit from the State Education Department as required for the Project. The Contractor shall secure and pay for all other permits and governmental fees, licenses, and inspections necessary for proper execution of and completion of the Contract that are legally required when bids are received. The Contractor shall procure and obtain all bonds required of the Owner or the Contractor by the municipality in which the Project is located or by any other public or private body with jurisdiction over the Project. In connection with such bonds, the Contractor shall prepare all applications, supply all necessary back-up material and furnish the surety with any required personal undertakings.

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§ 3.7.1.1 The Contractor shall, as soon as practicable, furnish the Owner, Architect, and Construction Manager with copies or certificates of all permits, fees, licenses, and inspections necessary for the proper execution and completion of the Work, including, without limitation, all applicable building permits other than those required of the Owner under Sections 2.2.1 and 3.7.1. All inspection fees and other costs of such permits and licenses required to be obtained by the Contractor as may be imposed by any municipal or other entity shall be paid by the Contractor and shall not serve as the basis for any increase in the Contract Sum.

§ 3.7.2 The Contractor shall comply with, and give notices required by, applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work. If the Contractor fails to give such notices, it shall be liable for and shall indemnify and hold harmless (a) the Owner, its consultants, employees, officers and agents and (b) the Architect, Construction Manager and their consultants, employees, officers and agents against any resulting fines, penalties, judgments, or damages, including reasonable attorney's fees, imposed on or incurred by the parties indemnified hereunder.

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§ 3.7.2.1 In accordance with New York State Labor Law Article 8, Section 220, subd. 3-a(a), the Contractor shall submit to the Owner within 30 days after issuance of Contractor's first payroll, and every 30 days thereafter, a transcript of the original payroll record, subscribed and affirmed as true under the penalties of perjury.

§ 3.7.2.2 The Contractor shall comply with all applicable New York State Department of Labor requirements, including the provision that every worker employed in performance of a public work contract shall be certified as having completed an OSHA 10-hour safety training course. The Contractor and its Subcontractors shall be solely responsible for compliance with this requirement with respect to their employees. The Contractor's or Subcontractor's failure to comply with this requirement shall not transfer or in any way impose the responsibility for worker safety upon the Owner or the Architect.

§ 3.7.3 If the Contractor performs Work contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear all costs attributable to the correction thereof or related thereto, including reimbursement to the Owner for any additional services required of the Construction Manager or Architect or both, as well as all fines and penalties, if any.

§ 3.7.4 Concealed or Unknown Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide written notice to the Owner, Construction Manager, and the Architect before conditions are disturbed and in no event later than five (5) days after first observance of the conditions; provided that, in the case of a condition at the site that involves hazardous or toxic substances, as those terms are defined by OSHA or AHERA, notice to the Owner, the Construction Manager and the Architect shall be given immediately upon discovery of such hazardous or toxic substance. The Architect and/or Construction Manager will promptly investigate such conditions and, if the Architect, in consultation with the Construction Manager, determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect, in consultation with the Construction Manager, determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner, Construction Manager, and Contractor in writing, stating the reasons. If the Contractor disputes the Architect's determination or recommendation, it may proceed as provided in Article 15. No adjustment in the Contract Time or Contract Sum will be permitted, however, in connection with a concealed or unknown condition that does not differ materially from those conditions disclosed or that reasonably should have been disclosed by the Contractor's (1) prior inspections, tests, and reviews, or (2) inspections, tests, and reviews the Contractor had the opportunity to make or should have performed in connection with the Project.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner, Construction Manager, and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until

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otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents:

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2. The Contractor is not entitled to overhead and profit on unexpended allowance amounts or any portions thereof.

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§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor, within seven (7) days of Notice of Award, shall designate the Project Manager, Superintendent and other key individuals who shall be assigned to the Project through and including Final Completion. Such designations shall be in writing and provided to the Architect, Owner and Construction Manager. The Superintendent shall be in attendance at the Project site throughout the Work, remain on the Project site not less than eight hours per day, five days per week, until termination of the Contract, unless the job is suspended, the Work is stopped by the Owner, or no Work is scheduled. To the extent Work is being performed contemporaneously at different facilities of the Owner, the Contractor shall assign different superintendents for each facility at which Work is being performed. The Project Manager and Superintendent assigned by the Contractor shall not be changed except with the consent of the Owner, unless the Project Manager or Superintendent or such assistant proves to be unsatisfactory to the Contractor and/or ceases to be in its employ. The Project Manager and Superintendent shall be approved by the Owner in its sole discretion. Said representatives shall be qualified in the type of work to be undertaken and shall not be changed during the course of construction without the prior written consent of the Owner. Should a representative leave the Contractor's employ, the Contractor shall promptly designate a new representative. The Owner shall have the right, at any time, to direct a change in the Contractor's representatives if their performance is unsatisfactory. In the event of such a demand, the Contractor shall within seven (7) days after notification thereof, replace said individual(s) with an individual(s) satisfactory to the Owner, in the Owner's sole discretion. If said replacement is disapproved, the Contractor may, at the Owner's option, be terminated for cause. The Superintendent shall represent the Contractor, and communications given to the Superintendent shall be as binding as if given to the Contractor. The Owner shall have no obligation to direct or monitor the Contractor's employees. All references herein to the Superintendent shall be taken to mean the Contractor's superintending staff. Each Subcontractor shall designate the Project Manager, Superintendent and other key individuals who shall be assigned to the Project. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case. The Contractor's Superintendent shall attend all Project meetings, regardless of whether held prior to or following Substantial Completion of the Work.

§ 3.9.2 The Contractor shall provide, or otherwise see that, the Project Manager or Superintendents or responsible workers of the Contractor and its major Subcontractors are equipped with cellular phones and radios. The Contractor shall provide the Owner, the Construction Manager and the Architect with the number for each phone and worker.

§ 3.9.3 The Contractor's supervisory personnel, including Superintendents and their assistants, shall be versed in the English language. In the event the Contractor's supervisory personnel, Superintendents and their assistants are not versed in the English language, the Contractor shall employ the services of a full-time on-site interpreter to facilitate communications with such supervisory personnel.

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§ 3.9.4 Prior to the commencement of Work, the Contractor shall provide the Construction Manager and the Architect with:

.1 A written list of the names, addresses and telephone numbers of the members of its organization who can be contacted in the event of an off-hours emergency at the building site, including cellular telephone numbers and personal/home telephone numbers;

.2 A written list of subcontractors, sub-subcontractors, suppliers and vendors with names, addresses, telephone numbers, and descriptions of the work they shall perform or furnish;

.3 The name, address and telephone number of the bonding company, banking and insurance company for the Contractor including the name, address and telephone number of each bonding company's primary contact representative for the Project;

.4 Detailed Subcontractor schedules indicating the approximate quantity of shop drawings, sequence, timing and man loading; and

.5 A cash flow projection for the life of the Project, including a schedule and graph showing the amount of Work projected to be completed each month or billing period and a dollar value for the anticipated billings each month or billing period. This shall be completed after an agreed upon schedule of values has been approved by the Construction Manager.

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§3.9.5 The Contractor shall not reduce or terminate supervision of the Work, nor change the superintendent without the prior written approval of the Owner.

§3.9.6 If, for any reason, the Contractor takes an action resulting in any of the changes noted in Subsection 3.9.5, the Owner may take remedial action to insure continued progress of the Work, including the hiring of suitable supervisory personnel, and charge the Contractor all costs associated with these remedial actions including the costs of legal and additional construction management and architectural services.

§ 3.9.7 The Contractor recognizes and acknowledges that job meetings will be held at the job site weekly as set forth in the Project Manual, unless otherwise designated by the Owner, Construction Manager or the Architect. The Contractor shall have responsible representation at the mandatory weekly job progress meetings held at the Construction Manager's job office and the Contractor acknowledges that it has included in its bid a sum of $250.00 per meeting for at least 50 meetings to have an authorized individual in attendance capable of making decisions and providing direction. This amount will be listed as a separate line item on the Contractor's schedule of values. If the Contractor misses a meeting without prior written authorization from the Construction Manager, it will be issued a deduct Change Order in the amount of $250.00 per occurrence. These progress meetings will be held to arrange for satisfactory coordination of all trades on the Project so as not to impede job progress. If the Contractor or its Subcontractors fails to attend job meetings, the Contractor shall be responsible for delays and expenses incurred due to coordination difficulty.

§ 3.9.8 The Contractor shall provide copies of its daily construction reports to the Construction Manager's Field Superintendent. These reports shall be submitted no later than 10:00 am the following workday. The daily reports shall provide detailed information concerning the Contractor's activities and operations, including Work activities on site and manpower. A "Daily Construction" form is included in these specifications and shall be used for reporting these activities. In addition, the Contractors are to submit a Two Week Look Ahead schedule for upcoming Work. A "Two Week Look Ahead" form is included in these specifications for the Contractor's use.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, within 15 days of Notice of Award, shall prepare and submit for the Owner's and Architect's information and the Construction Manager's approval a Contractor's construction schedule for the Work in electronic format with predecessor logic. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the dates of Substantial Completion and final completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The Contractor's construction schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The Contractor shall cooperate with the Construction Manager in scheduling and performing the Contractor's Work to avoid conflict with, and as to cause no delay in, the work or activities of other Multiple Prime Contractors or the construction or operations of the Owner's own forces. The Contractor's construction schedule shall be updated every thirty (30) days and submitted to the Construction Manager with the Contractor's Applications for Payment.

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§ 3.10.1.1 Time is of the essence for this Project. The Work shall be performed continuously and without interruption, so that all Work can be completed in the time set forth in the Contract Documents. The accepted construction schedule shall be dated to reflect actual conditions (sometimes referred to as progress reports) as set forth in this Section or if requested by the Owner, Construction Manager or Architect.

§ 3.10.1.2 The sequence of the Work shall be scheduled with the Owner so as to minimize interference with the Owner's use of existing structures, and the Owner's approval shall be obtained prior to starting of the Work.

§ 3.10.2 The Construction Manager shall prepare, publish, and, from time-to-time, revise a master integrated Project Schedule based upon the construction schedules submitted by the Contractor and other Contractors. Failure by the Contractor to furnish any required schedule or schedule revision in a timely manner shall entitle the Construction Manager to prepare a schedule for the Contractor's Work, to which the Contractor shall be bound.

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§ 3.10.2.1 The Contractor shall cooperate with the Construction Manager in scheduling and performing the Contractor's Work to avoid conflict, delay in or interference with the Work of other Contractors or the construction or operations of the Owner's own forces. The Owner shall have the right, without penalty, to direct the Contractor to delay, postpone or reschedule any portion of the Work that may interfere with or disrupt the operations of the Owner.

§ 3.10.3 The Contractor's construction schedule shall be in a detailed precedence style critical path management ("CPM") or Primavera-type format satisfactory to the Owner and Construction Manager that shall also: (i) provide a graphic representation of all activities and events that will occur during the performance of the Work; (ii) identify each phase of construction and occupancy; and (iii) set forth dates that are critical in ensuring the timely and orderly completion of the Work in accordance with the requirements of the Contract Documents.

§ 3.10.4 The Contractor shall conform to the most recent Project schedule. In the event the Owner determines that the performance of the Work has not progressed to the level of completion required of the Contract Documents or that the Contractor has failed to maintain its construction schedule or the Project schedule, the Owner shall have the right to order the Contractor to take corrective measures necessary to expedite the progress of construction including without limitations, additional shifts, overtime, additional manpower or equipment as well as other similar measures (hereinafter referred to collectively as "extraordinary measures"). Such extraordinary measures shall continue until the progress of Work complies with milestone and critical path dates set forth in the Contract Documents and the Project schedule. The Contractor shall not be entitled to an adjustment in Contract Sum or Contract Time in connection with extraordinary measures required by the Owner.

§ 3.10.5 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter update it as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Construction Manager's and Architect's approval. The Architect and Construction Manager's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Construction Manager and Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.6 The Contractor shall participate with other Contractors, the Construction Manager and Owner in reviewing and coordinating all schedules for incorporation into the Project schedule that is prepared by the Construction Manager. The Contractor shall revise the construction schedule and submittal schedule as deemed necessary by the Construction Manager to conform to the Project schedule and the Contract Documents.

§ 3.10.7 The Contractor shall perform the Work in general accordance with the most recent construction schedules submitted to the Owner, Construction Manager and Architect and incorporated into the approved Project Schedule. The Contractor shall monitor the progress of the Work for conformance with the requirements of the construction schedule and Project schedule and shall promptly advise the Owner of any delays or potential delays affecting the critical path.

§ 3.10.8 If the Contractor fails to maintain the approved construction schedule or Project schedule and meet all critical path dates for the Work, the Owner may request a recovery plan from the Contractor and reserves the right to withhold payment until such time as the Contractor submits a recovery plan. The recovery plan must show how the

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Work may plausibly be brought on schedule, including, as necessary, acceleration of the Work by means of overtime, additional crews, additional shifts, additional equipment or re-sequencing of the Work to achieve completion of the remaining critical path dates in the construction schedule or Project schedule. The Contractor shall submit as part of its recovery plan: (i) a "resource loaded" schedule showing the Contractor's plan to deploy manpower per trade, per work area, per day, together with essential materials and equipment, and other resources necessary to timely accomplish the Work; and (ii) a two-week "look ahead" schedule identifying tasks to be accomplished within the coming two week period, the work areas and categories of work, and necessary manpower resources, together with other data necessary to demonstrate to the Owner the viability of the Contractor's recovery plan ("2 Week Plans"). The Contractor shall continue to submit 2 Week Plans until either the Contractor demonstrates that the Project schedule has recovered from the unexcused delay, or the Owner notifies the Contractor in writing that further 2 Week Plans are no longer required. The cost of preparing and performing the recovery plan shall be borne solely by the Contractor. No approval or consent by the Owner of any plan for resequencing or acceleration of the Work submitted by the Contractor shall constitute a waiver by the Owner of any damages or losses which the Owner may suffer by reason of such resequencing or the failure of the Contractor to meet the Substantial Completion Date or the final completion date.

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§ 3.10.9 The Contractor specifically represents and warrants to the Owner that that the Contract Sum and the Contract Time contemplate compliance with all current, and reasonably foreseeable future, federal, state and local "Stay at Home," "Social Distancing" and related orders, regulations and guidance related to limiting the spread of COVID-19 disease (the "COVID Requirements"). Accordingly, the Contractor hereby waives any claim for an increase in the Contract Sum or an extension of the Contract Time on account of the COVID Requirements. The Contractor shall promptly notify the Owner of any COVID Requirements that would impact the Project.

§ 3.10.10 Due to the ongoing COVID-19 pandemic and the resulting uncertainty with regard to, among other things, (a) what restrictions, if any, will be applicable to construction activities due to federal, state or local orders, laws, regulations or rules related to the COVID-19 pandemic (including, without limitation, social distancing, PPE, cleaning and disinfection requirements) and (b) the duration of any restrictions imposed on construction activities, the Owner may modify the construction schedule set forth in the Contract Documents. Similarly, restrictions, if any, that will be or are applicable to construction activities due to federal, state or local orders, laws, regulations or rules related to the COVID-19 pandemic (including, without limitation, social distancing, PPE, cleaning and disinfection requirements) may cause the Owner to have the Work or the Project commence later than the date specified in the Contract Documents. The Contractor acknowledges and agrees that there should be no additional compensation paid for schedule modifications caused directly or indirectly by the COVID-19 pandemic. The Contractor further acknowledges and agrees that its sole remedy for any schedule modifications or delays caused directly or indirectly by the COVID-19 pandemic shall be an extension of the Contract Time, if warranted. The Contractor further acknowledges and agrees that it shall have on file and provide a copy to the Owner of its written COVID-19 business reopening plan, and it shall comply in all respects with such plan for the duration of the Project. The Contractor, not the Owner, shall be responsible for compliance with its COVID-19 business reopening plan and all safety requirements associated with COVID-19 protections for workers and the general public.

§ 3.11 Documents and Samples at the Site

§ 3.11.1 The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These documents shall be available to the Architect and delivered to the Construction Manager for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.11.2 The Contractor shall maintain at the site, and shall make available to the Owner, Construction Manager and Architect, one record copy of the Drawings (the "Record Drawings") in good order. The Record Drawings shall be prepared and updated during the prosecution of the Contractor's Work. The prints for Record Drawing use will be a set of black line prints provided by the Architect to the Contractor at the start of construction. The Contractor shall maintain said set in good condition and shall use colored pencils to mark up said set with "record information" in a legible manner to show: (i) deviations from the Drawings made during construction; (ii) details in the Work not previously shown; (iii) changes to existing conditions or existing conditions found to differ from those shown on any existing drawings; (iv) the actual installed position of equipment, piping, conduits, light switches, electric fixtures, circuiting, ducts, dampers, access panels, control valves, drains, openings, and stub-outs, etc.; (v) architectural or structural changes in the design; and (vi) such other information as either the Owner or Architect may reasonably request. At the completion of the work, the Contractor shall transfer all information on record drawings to

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reproducible drawings with new information clouded and noted. Such drawings shall be stamped with the Contractor's name and "AS-BUILT" in the lower righthand corner. The colored record drawings and the as-built reproducible drawings and a digital copy of same shall be forwarded to the Construction Manager for delivery to the Owner. Final payment and any retainage shall not be due and owing to Contractor until the Record and As-Built drawings receive the approval from the Architect and the Owner (and all other closeout requirements are met).

§ 3.11.3 The Contractor shall maintain all approved permit drawings in a manner so as to make them accessible to government inspectors and other authorized agencies having jurisdiction over the Project. All approved drawings shall be wrapped, marked and delivered to the Owner within 60 days of final completion of the Contractor's Work.

§ 3.12 Shop Drawings, Product Data, and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work. Each submittal shall bear written confirmation that the Contractor has satisfied its obligations under the Contract Documents with respect to the Contractor's review and approval of the submittal.

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§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, operating and maintenance procedures, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect and Construction Manager is subject to the limitations of Sections 4.2.10 through 4.2.12. Informational submittals upon which the Construction Manager and Architect are not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Construction Manager or Architect without action.

§ 3.12.4.1 Shop Drawings and product submittals for all site improvement, architectural, structural, mechanical, electrical and signal work shall be submitted to the Architect for its review. Refer to the Specifications Section 01 33 00 – "Submittals" for more complete information. Reference to Section 3.12 elsewhere in the Contract Documents shall also be read as referring to Section 01 33 00 of the Specifications.

§ 3.12.4.2 The Contractor represents and warrants that all shop drawings shall be prepared by a person or entity possessing expertise and experience in the trade for which the shop drawing has been prepared and, if required by the Contract Documents or law, by a licensed professional engineer.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Construction Manager, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the Project submittal schedule approved by the Construction Manager and Architect or, in the absence of an approved Project submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of other Contractors, Separate Contractors, or the Owner's own forces. The Contractor shall cooperate with the Construction Manager in the coordination of the Contractor's Shop Drawings, Product Data, Samples, and similar submittals with related documents submitted by other Contractors.

§ 3.12.5.1 No extension of time will be granted to the Contractor because of failure to have Shop Drawings, Product Data, Samples or similar submittals submitted in ample time to allow for review by the Architect or its consultants.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner, Construction Manager, and Architect, that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents. Time is of the essence for this Project. The Work shall be performed continuously and without interruption, so that all Work can be completed in the time set forth in the Contract

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Documents. The accepted construction schedule shall be dated to reflect actual conditions (sometimes referred to as progress reports) as set forth in this Section or if requested by the Owner, Construction Manager or Architect

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been reviewed and approved by the Architect. Resubmission of rejected documents shall be performed within ten (10) calendar days, or sooner if required by the progress of construction. No claim for delay or cost shall be accepted as a result of rejected submittal documents. If the Architect is required to review the Contractor's submittal more than twice, the Contractor shall bear the cost and expense associated with such additional review.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Construction Manager and Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

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§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Construction Manager and Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions. Resubmission of rejected documents shall be performed within ten (10) calendar days. No claim for delay or cost shall be accepted as a result of rejected documents.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, who shall comply with reasonable requirements of the Owner regarding qualifications and insurance, and whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Construction Manager and Architect at the time and in the form specified by the Architect.

§ 3.12.11 The Architect's review of the Contractor's submittals will be limited to examination of an initial submittal and one resubmittal. The Owner is entitled to obtain reimbursement from the Contractor for amounts paid to the Architect for evaluation of additional resubmittals.

§ 3.13 Use of Site

§ 3.13.1 The Owner shall not be liable to the Contractor, its Subcontractors of any tier, Suppliers, their employees or anyone else with respect to the condition of the Project site. The Owner shall have the right to refuse admittance to

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the site to any agent or employee of the Contractor, its Subcontractors of any tier, or its Suppliers whose presence the Owner deems hostile to the Owner's interests. The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment. The use of the Owner's assets and property are extremely limited. The Contractor shall fully comprehend the intent of the Contract Documents pertaining to site and building limitations including, without limitation, Division 1 Specifications sections, the phased construction plan, and the site safety and logistics plan(s).

§ 3.13.2 The Contractor shall coordinate the Contractor's operations with, and secure the approval of, the Construction Manager before using any portion of the site.

§ 3.13.3 The Contractor shall perform and shall ensure that all its Subcontractors and Suppliers perform all Work in a manner that permits reasonable access to the Project site and to all adjacent premises. The Contractor shall not, and shall not permit any Subcontractor or Supplier to, conduct the Work in a manner that disturbs or that could be reasonably anticipated to disturb operations and persons located in or on portions of the site not affected by the Work. The occupied portion of any of the Owner's buildings shall always comply with the minimum requirements necessary to maintain a certificate of occupancy.

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§ 3.13.4 Construction Rules and Regulations. The following rules and regulations shall be observed and enforced by all Contractors in connection with all phases of the Work:

.1 In accordance with New York State law, smoking is prohibited anywhere on school property. Violators will be subject to arrest and/or fine of $1,000 per occurrence. No alcoholic beverages or controlled substances are permitted on school property, and persons under the influence of alcoholic beverages or controlled substances may not enter in or remain on school property.

.2 In accordance with the United States Gun-Free School Zones Act of 1994, no firearms are permitted within 1,000 feet of any school building, with certain limited exceptions as set forth therein. In addition to such limitations, no firearms shall be brought on school property without the Owner's express prior consent.

.3 Appropriate protective gear (hard hats, safety shoes, goggles, etc.) are to be worn as required by OSHA standards, the New York State Department of Labor, and prudent practice. Shirts are to be worn at all times. No short pants are permitted.

.4 Any person who uses inappropriate language, or who is disruptive to the school environment, will be banned from the site.

.5 The Contractor's personnel shall not converse with school employees, students and or local residents.

.6 All persons on the Project site will comply with all reasonable instructions regarding conduct and safety which are given by the Architect, the Construction Manager or the Owner's school administrators.

.7 All construction materials shall be stored in a safe and secure manner. No deliveries will be allowed during school bus drop off or pick up hours as determined by the Owner. All deliveries shall be scheduled and coordinated with the Construction Manager and the Owner's Security department. Unexpected or uncoordinated deliveries may be turned away by the Owner or the Construction Manager at the discretion or necessity of the Owner. The Owner's enforcement of this provision shall not be construed by the Contractor or Subcontractor as the basis for a claim of delay in time or monetary damages alleged to have been incurred as a result of refusal of delivery.

.8 Use of the existing building facilities during construction is prohibited, specifically including toilet rooms, telephones and water fountains.

.9 The Contractor's schedule shall allow for blackout dates during which no noisy Work will be allowed, as determined by the Construction Manager. The Contractor may consult the Owner's school calendar for all test and examination dates, but these dates are subject to change.

.10 To gain access to the Work, entrances and parking areas will be designated by the Owner for the Contractor's use. Any vehicles or trucks in non-designated areas may be towed at the Contractor's expense. Gates shall always be locked unless a worker is in attendance to prevent unauthorized entry.

.11 Should it become necessary to obtain access to the existing building during construction hours for measurements or other non-disruptive work, the Contractor shall be escorted by the Construction Manager.

.12 All persons must wear photo identification badges at all times while working at the site. Identification badges must be provided by each prime Contractor for their respective personnel, including subcontractors, consultants, visitors and others. Each person without a badge shall be ordered to leave

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the Owner's property. The Contractor and its Subcontractors employing the offending person(s) shall be solely responsible for making up and paying for any loss production or required progress in the Work resulting from this action (including any claims by other Contractors dependent on the work of this Contractor).

.13 No asbestos containing products are to be used anywhere on this Project.

.14 No lead containing products are to be used anywhere on this Project.

.15 Asbestos manifests showing the locations of all known asbestos bearing materials are available in each building, and should be consulted prior to the commencement of any work, including but not limited to demolition.

.16 Demolition is to occur only when the building is unoccupied. Dust partitions and negative air are to be installed prior to commencing demolition. The Contractor must obtain Construction Manager approval on dust partitions and negative air prior to commencing demolition work. Debris shall be removed by using an enclosed chute or similar sealed system.

.17 (a) Prior to the commencement of Work, the Contractor must submit construction plans, which show the location of dust particles, exhaust & fresh air fans and describe in detail the operation procedures during demolition and construction which may generate dust.

(b) All entrances to classrooms shall be sealed with at least 6 mil. polyethylene sheeting to prevent dust created by demolition and construction work from entering the classrooms. Entrances and egress to the work zone shall be covered with a triple flap 6 mil. polyethylene doorway to allow access to the area without the release of dust. The Contractor is additionally responsible for all debris and dust infiltrating adjacent and undisturbed areas of the building.

(c) Shut down and lock out all electrical and HVAC in the work area. Cut, cap, and seal all duct work where it enters the work area from another space. All duct work and conduit within the space shall be removed during demolition work.

(d) The Contractor shall install dust protection barriers and poly sheeting. There shall be no or minimum damage to adjacent surfaces. The Contractor is responsible to repair any damage to existing surfaces.

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.18 Painting or other chemical applications shall be done in the Owner's existing building only when it is unoccupied. Storage of chemicals and painting shall be outside the Owner's existing or new structures, and shall follow manufacturer's storage guidelines.

.19 Oxygen or other gas containers shall be properly stored and secured per OSHA requirements, to the satisfaction of the Construction Manager. Failure to do so will result in a $250 back-charge, per occurrence.

.20 The Contractor is responsible for cleaning its own materials and debris. Failure to maintain a clean work site daily will result in others performing the work at the Owner's request, and the Contractor will be back-charged for the cleaning cost plus construction administration fees. This may be done without the typical 3-day notice to the Contractor.

.21 The Contractor must send a qualified representative, knowledgeable in the Project and authorized to make decisions on behalf of the Contractor, to every Project meeting.

.22 The Contractor shall cooperate with the Owner's school principal and custodial staff; however, if any additional work is requested the Contractor shall not proceed unless written approval is received from the Owner. The Contractor will not be compensated for any additional work performed without the Owner's prior written approval.

.23 Deliveries sent to the Project site will not be signed for or unloaded by the Owner. They will be directed to the construction site and if no employee is on site, the delivery will be rejected, at the Contractor's expense.

.24 The General Construction Contractor shall be responsible for managing dust and dirt. On the exterior, site shall be watered down frequently to prevent dust clouds from rising. Streets shall be maintained clean per the Construction Manager's request.

.25 All hot tar roofing shall be installed after school hours or on weekends/holidays only. Kettles shall not be lit until all students have left the Owner's building.

.26 The Contractor shall submit a weekly work schedule indicating work days, work hours and manpower allocation.

.27 No storage of materials will be permitted within the Owner's buildings at any time during construction. The Contractor must provide exterior storage containers when required. The Contractor shall be responsible for securing appropriate space for its material with the Construction Manager prior to delivery. Final location of storage containers shall be determined by the Owner and/or Construction Manager. If insufficient space is available on the site, the Contractor shall provide local

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off-site storage, storage containers, etc. at its own cost and expense. Should any of the material stored on-site obstruct the progress of any portion of the Work or the Project, this material shall be removed by the Contractor without reimbursement of cost, from place to place or from the premises, as the Construction Manager may direct.

.28 The General Construction Contractor shall be responsible for maintaining all appropriate site safety signage.

.29 The Contractor shall be responsible for protecting the Owner's property. All existing shrubs, trees, lawn fixtures, sculptures and miscellaneous equipment shall be protected at all times. Any removals or relocation of said objects, if allowed shall be as directed by Owner in writing.

.30 The General Construction Contractor shall provide and service portable lavatories for the duration of construction as provided in the Contract Documents. Lavatories shall be serviced by the General Construction Contractor on a regular basis to maintain sanitary conditions.

.31 The General Construction Contractor shall protect all existing roofs during construction and shall be responsible for any damage to roofs during construction. The General Construction Contractor shall make all repairs to any damaged areas, as required by the manufacturer of the roof system.

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.32 The General Construction Contractor shall be responsible for providing weather-proof protection over all rough openings, including windows.

.33 Five (5) days after receipt of the Notice to Proceed, the Contractor shall provide two (2) copies of a videotaped recording of all existing conditions to the Construction Manager. This taping shall provide a record of all existing buildings, grounds, exterior conditions and interior conditions. The Contractor shall schedule a representative of both the Owner and the Construction Manager to be present at this taping. In the absence of this record, the Contractor shall be responsible for paying the costs associated with any and all repairs in an area where the Contractor is working or has worked, as may be deemed necessary by the Owner or the Construction Manager.

.34 Manufacturers Material Safety Data Sheets (MSDS) shall be available at the site for all products used in the Project.

.35 No weapons are permitted on the Owner's property by law.

.36 No Contractor, Subcontractor, nor any person on its behalf shall, in any manner, engage in discrimination, intimidation or harassment of any person on the Project site.

.37 Proper attire is required for personal safety and clothing must not sexually explicit or contain messages of a vulgar nature, disrespectful of ethnic or religious groups, or which promote the use of tobacco, alcohol or drugs.

.38 Only materials and equipment that are to be used directly in the Work shall be brought to and stored on the Project site by the Contractor. After equipment is no longer required for the Work, it shall be promptly removed from the Project site. Protection of construction materials and equipment stored at the Project site from weather, theft, damage, and all other adversity is solely the responsibility of the Contractor.

.39 The Contractor will ensure that the Work, at all times, is performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. The Work will be performed in such a manner that public areas adjacent to the site of the Work will be free from all debris, building materials and equipment likely to cause hazardous conditions. Without limitation of any other provision of the Contract Documents, the Contractor will use its best efforts to minimize any interference with the occupancy or beneficial use of (1) any areas and buildings adjacent to the site of the Work; or (2) the Owner's building in the event of partial occupancy, as more specifically described in Section 9.9.

.40 The Contractor is required to protect its Work and work areas, preconstruction, during construction and post construction.

.41 During exterior renovation work, overhead protection shall be provided for any sidewalks or areas immediately beneath the work site or such areas shall be fenced off and provided with warning signs to prevent entry.

.42 The Contractor shall exert utmost care and diligence when working in or near any existing buildings or site work. The absence of protection around such items shall not excuse the Contractor from its liability to provide protection. Any damage to existing buildings, sitework or facilities shall be repaired and charged to the Contractor responsible for the damage.

.43 The Contractor shall be responsible for the removal and replacement of existing ceiling tiles and grid in areas of the existing building where its Work is required and new ceilings are not scheduled for installation. In the event that the existing ceilings are damaged and cannot be replaced to the

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satisfaction of the Owner, the responsible contractor shall be liable for the costs of replacing in kind, the existing ceilings with new tile and grid.

.44 The General Construction Contractor shall provide necessary and required security measures to adequately safeguard the construction site from vandalism and intrusion of unauthorized persons. The General Construction Contractor shall submit its means and methods of security to the Construction Manager for review and comment. The Project site must be secured 24 hours a day, 7 days a week including holidays. The General Construction Contractor's failure to secure the site as required by this paragraph will result in the Owner engaging the services of such necessary personnel so as to provide such security. No notice will be given the General Construction Contractor of the Owner's intention to engage such security services and all costs and expenses associated with the Owner's security of the site in this regard will be back charged to the General Construction Contractor. While the Owner may have security guards patrolling the project areas, the function of such security guards is not for the purpose of specifically guarding the Contractor's property or operations of work.

.45 The Contractor and any entity for which the Contractor is responsible shall not erect any sign on the Project site without the written consent of the Owner, which may be withheld in the sole discretion of the Owner.

.46 Without limitation of any other provision of the Contract Documents, the Contractor will comply with all reasonable rules and regulations promulgated by the Owner or Construction Manager in connection with the use and occupancy of the Project site and the buildings, as amended from time to time by the Owner or the Construction Manager.

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§ 3.13.5 Separation of Construction Areas from Occupied Spaces: Construction areas which are under the control of the Contractor and therefore not occupied by the Owner's staff or students shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the Owner's building. Periodic inspection and repairs of the containment barriers must be made to prevent exposure to dust or contaminants. Gypsum board must be used in exit ways or other areas that require fire rated separation. Heavy duty plastic sheeting may be used only for vapor, fine dust or air infiltration barrier, and shall not be used to separate occupied spaces from construction areas. Methods of dust and fume control shall include, but not be limited to:

.1 Adequate ventilation;
.2 Wetting down;
.3 Keeping bags of insulating materials, cement, etc. closed;
.4 Controlled mixing of materials under field conditions;
.5 Special attention should be used in sawing insulation and certain acoustical materials and storage of materials;
.6 Job housekeeping must be maintained; and
.7 Advising all personnel of hazardous conditions, including supervisors and workers.

§ 3.13.6 Prior to starting Work, the Contractor shall submit a written report to the Owner, Construction Manager and Architect identifying existing damage to roads, walks, lawns, buildings and other property to be affected by this Contract. Failure to submit the report shall render the Contractor responsible for existing damage. The Contractor may request and schedule an inspection with the Owner, Construction Manager and Architect prior to submittal of the report. The Contractor shall obtain the consent of adjoining property owners regarding temporary easements of any other manner of physical encroachment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner, Separate Contractors, or of other Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner, Separate Contractors, or by other Contractors except with written consent of the Construction Manager, Owner, and such other Contractors or Separate Contractors. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Separate Contractors, other Contractors, or the Owner, its consent to cutting or otherwise altering the Work.

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§ 3.14.3 The word "new" used herein shall mean Work which has been or is to be installed under the terms of the Contract for this Project. The word "existing" used herein shall mean existing conditions previous to the award of a Contract for this Project. In order to eliminate cutting and patching as much as possible, the Contractor shall, during the progress of its Work, provide and set proper sleeves, inserts, and other fixtures as required for its new Work and shall give proper and detailed instructions to others where the Work may be affected by their work, with adequate notice prior to the erection of new Work. Cutting and patching work as required to install new Work or remove existing work shall be done carefully and neatly with as little damage as possible. The Contractor shall refer to the Specifications for proper cutting and patching requirements. Any costs caused by defective or ill-timed Work of the Contractor shall be borne by the Contractor. Cutting and patching of any Work shall be made in such a manner as to not breach any provisions of any guaranty or warranty on existing work left in place or any guaranty or warranty required for the Contractor's new Work. Patching of work shall match existing adjacent surfaces and patchwork shall be disguised completely to hide any trace of patching. All new Work on existing roofs must be provided by a company specializing in performing the Work and approved by the existing roofing material manufacturer. It shall be the responsibility of the Contractor performing the cutting and patching to maintain any existing roofing warranty.

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§ 3.14.4 Only trades persons skilled and experienced in cutting and patching shall perform such work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. On a daily basis, the Contractor shall clean the areas in which it has performed work and shall remove all waste, materials, rubbish, its tools, construction equipment, machinery and surplus materials. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project. The Contractor shall completely clean the site of the Work, removing and disposing of all construction-related debris and rubbish, and cleaning all Work-related stains, spots, marks, dirt, mortar smears, plaster smears, paint smears, caulking smears, and other foreign materials from exposed surfaces inside and outside the Owner's buildings and within the Project limit lines.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner, or Construction Manager with the Owner's approval, may do so and the Owner shall be entitled to reimbursement from the Contractor. At its option, the Owner may deduct the cost of clean-up pursuant to this Section 3.15.2 from any payments otherwise due to the Contractor pursuant to this Contract.

§ 3.16 Access to Work

The Contractor shall provide the Owner, Construction Manager, and Architect with access to the Work in preparation and progress wherever located. Federal, state, and local agencies with jurisdiction over the Project shall at all times have access to the Work wherever it is in preparation or progress. The Contractor shall provide for such access so that such agencies may perform their functions. The Contactor shall also allow access for all required tests and inspections.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner, Construction Manager, and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner, Architect, or Construction Manager. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect through the Construction Manager.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall, and cause its Subcontractors to, defend, indemnify and hold harmless the Owner, Construction Manager, Architect, and their consultants, officers, directors, board members, agents and employees of any of them (collectively, "Indemnitees," individually, "Indemnitee") from and against all losses, damages, liabilities, actions, causes of action, claims, demands, fines, penalties, judgments, costs (including but not limited to attorneys' fees and expenses incurred in connection therewith and in the enforcement of this indemnification), charges, expenses and demands of whatever kind in connection with or

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arising from or out of (a) any negligent, willful or wrongful act or omission resulting in bodily injury (including death), personal injury or property damage (including loss of use) by the Contractor, its Subcontractors and Suppliers, their respective officers, employees, servants, agents, suppliers, invitees, successors and assigns (collectively, "Contractor Parties," and individually, "Contractor Party"), (b) performance of or failure to perform the Work or any breach of this Contract or infringement of any patent right by any Contractor Party, or (c) any statutorily imposed liability for injury to employees or failure to comply with any laws or regulations affecting the Work, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Nothing contained herein shall be construed to obligate the Contractor to indemnify, defend, and hold an Indemnitee harmless for claims caused solely by the Indemnitee's negligent acts or omissions.

The Contractor agrees to include the following indemnity provision in each and every contract it enters into with a Subcontractor, and to require that Subcontractor to include such provision in each contract it enters into with any lower tier Sub-subcontractor: "To the fullest extent permitted by law, Subcontractor shall defend, indemnify and hold harmless the Contractor, Owner, Owner's Consultants, Construction Manager's and Architect's consultants, and each of their respective representatives, board members, employees, directors, officers, and agents, from and against any and all claims, suits, actions, damages, losses, fines, penalties, costs, charges and expenses, including but not limited to attorneys' fees and the costs of any proceeding, arising out of or resulting from any performance of or failure to perform the Work, acts or omissions of the Subcontractor, its lower-tier Sub-subcontractors, and others for whom the Subcontractor is responsible, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or economic losses or damages, damage to or destruction of property, and for environmental damage, or to injury to or destruction of tangible property and nuisance, but only to the extent caused by the acts or omissions or a breach of contract of the Subcontractor, a Sub-Subcontractor to Subcontractor, and any person or entity directly or indirectly employed by them or any person or entity for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder."

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§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

§ 3.18.3 The Contractor's defense and indemnity obligations under this Section 3.18 shall specifically include all claims and judgments that may be made against the Indemnitees under the Labor Law of the State of New York, and similar laws of other state or governmental bodies having jurisdiction; and further, against claims and judgments arising from violation of public ordinances and requirements of governing execution of the Work.

§ 3.18.4 Claims by Governmental Authorities. To the fullest extent permitted by law, the Contractor shall defend, indemnify, and hold harmless the Indemnitees from and against claims, damages, losses, and expenses arising out of any claims made against the Indemnitees under the laws of federal, state, or other governmental bodies having jurisdiction over the Work, including but not limited to claims arising from violation of public ordinances and other requirements of governing authorities, due to the Contractor's method of execution of the Work or implementation of any of the Contractor's other obligations under the Contract Documents.

§ 3.18.5 Liens and Security Interests. To the fullest extent permitted by law, the Contractor shall defend, indemnify, and hold harmless the Indemnitees from and against any actions, lawsuits, or other proceedings brought against Indemnitees as a result of liens or security interests of any type arising from the Work and filed against the Work, the site of any of the Work, the Project site and any improvements thereon, payments due the Contractor, or any portion of the property of any of the Indemnitees.

§ 3.18.6 Intellectual Property. The Contractor shall defend, indemnify, and hold harmless the Indemnitees from and against any claim or demand for patent fees, royalties, or otherwise on account of any invention, machine, article, process, copyright, or arrangement that may be used by the Contractor in performing the Work, other than as to any of the foregoing expressly called for in the Contract Documents to be so used. In the event of any injunction or legal action regarding such claim or demand that results in stopping the Work in whole or part, the Owner shall have the right to direct the Contractor to change the manner of performance of the Work to avoid such stoppage, all cost and expense occasioned thereby to be borne solely by the Contractor.

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§ 3.18.7 The Contractor shall further indemnify and hold harmless the Indemnitees from and against any costs and expenses (including reasonable attorneys' fees) incurred by any of the Indemnitees in enforcing any of the Contractor's defense, indemnity, and hold harmless obligations under this Section 3.18 or as may otherwise be provided elsewhere in the Contract.

§ 3.18.8 Subject to Section 3.18.9, all obligations of the Contractor under this Section 3.18 to defend the Indemnitees are obligations to provide full defenses at the sole cost and expense of the Contractor, regardless of any alleged culpability on the part of any Indemnitee or any ultimate determination of relative shares of liability of any Indemnitee or limitation of the Contractor's indemnity obligations in light of such determination.

§ 3.18.9 To the extent any defense, indemnity, or hold harmless obligations under this Section 3.18 are made void or otherwise impaired by any law controlling their construction (including but not limited to laws limiting such obligations to the extent of the portion of damages caused by an indemnitor), such obligations shall be deemed to conform to the greatest rights to defense and indemnity permitted by such law (including but not limited to New York State General Obligations Law Section 5-322.1).

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§ 3.18.10 All provisions of this Section 3.18 shall survive termination of the Agreement or final completion. No obligations under this Section 3.18 shall be construed to negate, abridge, or reduce other rights or obligations to defense and indemnity, including but not limited to common law indemnity, which would otherwise exist as to a party or person described in this Section 3.18.

§ 3.19 Existing Features and Underground Data

§ 3.19.1 The location of existing features shown on plans is intended for general information only. The Contractor, alone, is responsible for accurate determination of the location of all structures, and shall not be entitled to any increase in the Contract Sum or Contract Time due to difficulties or distances encountered in the Work, which should have been foreseeable thereby.

§ 3.19.2 The locations, depths and data as to underground conditions have been obtained from records, surface indications and data furnished by others. Information furnished is solely for the convenience of the Contractor without any warranty, expressed or implied as to its accuracy or completeness. The Contractor shall make no claim against the Owner, Construction Manager or Architect with respect to the accuracy or completeness of such information if it is erroneous, or if the conditions found at the time of construction are different from those as indicated.

§ 3.20 Construction Stresses

§ 3.20.1 The Contractor shall be solely responsible for the conditions which develop during construction and in the event any structure is dislocated, over strained, or damaged so as to affect its usefulness, the Contractor shall be solely responsible. The Contractor shall, at its own expense, take whatever steps necessary to strengthen, relocate, or rebuild the structure to meet all applicable requirements.

§ 3.20.2 The Contractor is responsible for restoration and repair of utilities, private property, buildings, pavement, walkways, roads, or other property damaged by its activities under its Contract.

§ 3.21 Training and Instructions

§ 3.21.1 Upon Substantial Completion of the Work, the Contractor shall orient and instruct personnel of the Owner designated by it in the operation and maintenance of all equipment furnished by the Contractor and shall turn over all pertinent literature and operational manuals relating to the equipment. The format for organizing, binding, and delivering such manuals shall be as described in the Specifications. All Owner training sessions to be video recorded by the Contractor and digital copies provided to the Owner upon closeout for the Owner's future use.

ARTICLE 4 ARCHITECT AND CONSTRUCTION MANAGER

§ 4.1 General

§ 4.1.1 The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 4.1.2 The Owner shall retain a construction manager lawfully licensed to practice construction management or an entity lawfully practicing construction management in the jurisdiction where the Project is located. That person or

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entity is identified as the Construction Manager in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 4.1.3 Duties, responsibilities and limitations of authority of the Construction Manager and Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Construction Manager, and Architect. Consent shall not be unreasonably withheld.

§ 4.1.4 If the employment of the Construction Manager or Architect is terminated, the Owner shall employ a successor construction manager or architect whose status under the Contract Documents shall be that of the Construction Manager or Architect, respectively.

§ 4.2 Administration of the Contract

§ 4.2.1 The Construction Manager and Architect will provide administration of the Contract as described in the Contract Documents and will be the Owner's representatives during construction until the date the Architect issues the final Certificate for Payment and during the correction period described in Article 12. The Construction Manager and Architect have the authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

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§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. On the basis of the site visits, the Architect will keep the Owner and the Construction Manager reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner and Construction Manager known deviations from the Contract Documents and defects and deficiencies observed in the Work.

§ 4.2.3 The Construction Manager shall provide one or more representatives who shall be in attendance at the Project site whenever the Work is being performed. The Construction Manager will determine in general if the Work observed is being performed in accordance with the Contract Documents, will keep the Owner and Architect reasonably informed of the progress of the Work, and will promptly report to the Owner and Architect known deviations from the Contract Documents and the most recent Project schedule, and defects and deficiencies observed in the Work.

§ 4.2.4 The Construction Manager will schedule and coordinate the activities of the Contractor and other Contractors in accordance with the latest approved Project Schedule. The Contractor shall participate with other Contractors and the Construction Manager, the Architect and Owner in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall constitute the schedules to be used by the Contractor, other Contractors, the Architect, the Construction Manager and the Owner until subsequently revised.

§ 4.2.4.1 The Contractor will assume full responsibility for the execution of its Work in the allotted duration times set forth in the Project Schedule.

§ 4.2.5 The Construction Manager, except to the extent required by Section 4.2.4, and the Architect will not have control over, or charge of, construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1, and neither will be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. Neither the Construction Manager nor the Architect will have control over or charge of or be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons or entities performing portions of the Work.

§ 4.2.6 Communications Facilitating Contract Administration. Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Construction Manager, and shall contemporaneously provide the same communications to the Architect about matters arising out of or relating to the Contract Documents. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with other

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Contractors shall be through the Construction Manager and shall be contemporaneously provided to the Architect if those communications are about matters arising out of or related to the Contract Documents. Communications by and with the Owner's own forces shall be through the Owner.

§ 4.2.7 The Construction Manager and Architect will review and certify all Applications for Payment by the Contractor, in accordance with the provisions of Article 9.

§ 4.2.8 The Architect and Construction Manager have authority to reject Work that does not conform to the Contract Documents and will notify each other about the rejection. Whenever the Construction Manager considers it necessary or advisable, the Construction Manager will have authority to require additional inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, upon written authorization of the Owner, whether or not such Work is fabricated, installed or completed. The foregoing authority of the Construction Manager will be subject to the provisions of Sections 4.2.18 through 4.2.20 inclusive, with respect to interpretations and decisions of the Architect. However, neither the Architect's nor the Construction Manager's authority to act under this Section 4.2.8 nor a decision made by either of them in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect or the Construction Manager to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons performing any of the Work.

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§ 4.2.9 Utilizing the submittal schedule provided by the Contractor, the Construction Manager shall prepare, and revise as necessary, a Project submittal schedule incorporating information from other Contractors, the Owner, Owner's consultants, Owner's Separate Contractors and vendors, governmental agencies, and participants in the Project under the management of the Construction Manager. The Project submittal schedule and any revisions shall be submitted to the Architect for approval.

§ 4.2.10 The Construction Manager will receive and promptly review for conformance with the submittal requirements of the Contract Documents, all submittals from the Contractor such as Shop Drawings, Product Data, and Samples. Where there are other Contractors, the Construction Manager will also check and coordinate the information contained within each submittal received from the Contractor and other Contractors, and transmit to the Architect those recommended for approval. By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Construction Manager represents to the Owner and Architect that the Construction Manager has reviewed and recommended them for approval. The Construction Manager's actions will be taken in accordance with the Project submittal schedule approved by the Architect or, in the absence of an approved Project submittal schedule, with reasonable promptness while allowing sufficient time to permit adequate review by the Architect.

§ 4.2.11 The Architect will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Upon the Architect's completed review, the Architect shall transmit its submittal review to the Construction Manager.

§ 4.2.12 Review of the Contractor's submittals by the Architect is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.12.1 The Architect's review of Contractor's submittals shall be limited to an initial submittal and one (1) resubmittal. If the Architect is required to review additional submittals because the initial submittal and resubmittal failed to conform to the information given and the design concept expressed in the Contract Documents, the amount of compensation paid to the Architect by the Owner for additional services shall be deducted from the payments to the Contractor.

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§ 4.2.12.2 The review will not be considered complete until an "ACTION" stamp or other written notice to that effect has been received by the Contractor.

§ 4.2.13 The Construction Manager will prepare Change Order, Allowance Disbursements and Construction Change Directives forms.

§ 4.2.14 The Construction Manager and the Architect will take appropriate action on Change Orders or Construction Change Directives in accordance with Article 7 and the Architect will have authority to order minor changes in the Work as provided in Section 7.4. The Architect, in consultation with the Construction Manager, will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.15 Utilizing the documents provided by the Contractor, the Construction Manager will maintain at the site for the Owner one copy of all Contract Documents, approved Shop Drawings, Product Data, Samples and similar required submittals, in good order and marked currently to record all changes and selections made during construction. These will be available to the Architect and the Contractor, and will be delivered to the Owner upon completion of the Project.

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§ 4.2.16 The Construction Manager will assist the Architect in conducting inspections to determine the dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion in conjunction with the Architect pursuant to Section 9.8; and receive and forward to the Owner written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10. The Construction Manager will forward to the Architect a final Application and Certificate for Payment or final Project Application and Project Certificate for Payment upon the Contractor's compliance with the requirements of the Contract Documents.

§ 4.2.17 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such Project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.18 The Architect will interpret and decide matters concerning performance under, and requirements of the Contract Documents on written request of the Construction Manager, Owner or Contractor through the Construction Manager. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.19 Interpretations and decisions of the Architect will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor.

§ 4.2.19.1 If Work is described or indicated in a manner which makes it impossible to carry out the requirements of the Contract Documents, or should discrepancies appear among the Contract Documents, the Contractor shall request interpretation before proceeding with the Work. If the Contractor fails to make such a request, no excuse will be entertained for failure to carry out the Work of the Contract Documents. Should a conflict occur in or between Contract Documents, the Contractor is deemed to have included in the Contract Sum the more expensive manner of doing the Work.

§ 4.2.20 The Architect's decisions, after consultation with the Owner, on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.21 The Construction Manager will receive and review requests for information from the Contractor, and forward each request for information to the Architect, with the Construction Manager's recommendation. The Architect will review and respond in writing to the Construction Manager to requests for information about the Contract Documents. The Construction Manager's recommendation and the Architect's response to each request will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

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ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include other Contractors or Separate Contractors or the subcontractors of other Contractors or Separate Contractors.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.1.3 The term "Specialist" or "Specialty Contractor" as used in the Contract Documents shall mean an individual or firm of established reputation, or, if newly organized, whose personnel have previously established a reputation in the same field, which is regularly engaged in, and which maintains a regular force of workers skilled in either manufacturing or fabricating items required by the Contract, installing items required by the Contract, or otherwise performing work required by the Contract.

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§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, within ten (10) days after award of the Contract, shall furnish in writing to the Construction Manager for review by the Owner, Construction Manager and Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Construction Manager may reply within 14 days to the Contractor in writing stating (1) whether the Owner, the Construction Manager or the Architect has reasonable objection to any such proposed person or entity or, (2) that the Construction Manager, Architect or Owner requires additional time for review. Failure of the Construction Manager, Owner, or Architect to reply within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.1.1 In no case shall payments be made on the Contract until a complete list of Subcontractors has been submitted by the Contractor to the Construction Manager for review by the Owner, Construction Manager, and Architect. Such list shall not be considered complete if the Owner, Construction Manager or Architect has any reasonable objection to any name listed thereon. Such list shall be submitted and resubmitted if necessary until it is considered complete.

§ 5.2.1.2 Subcontractors will not be acceptable unless, when requested by the Owner, Architect or Construction Manager, evidence is furnished by the Contractor that the proposed Subcontractor has satisfactorily completed similar subcontracts as contemplated under this Contract, and has the necessary experience, personnel, equipment, plant and financial ability to complete the proposed subcontract in accordance with the intent of the Contract Documents and the Project Schedule. As verification of financial ability, the Owner reserves the right to request and receive up to five (5) years of financial statements, bank references, bond/insurance company references and all other information required to assess financial ability.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner, Construction Manager or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner, Construction Manager or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner, Construction Manager and Architect have no objection. No increase in the Contract Sum shall be allowed where a Subcontractor is rejected by the Architect, Construction Manager or Owner who is (1) deemed unqualified to perform the particular work subcontracted by the Contractor, (2) does not have the necessary experience, personnel, equipment, plant and financial ability to complete the subcontract, or (3) has a history of poor performance of work of similar nature. Upon receipt of a rejection of a Subcontractor by the Architect, the Contractor shall have the right to request a meeting with the Architect, Construction Manager and the Owner to discuss the reasons it believes the proposed Subcontractor is qualified to perform the work. Upon review of such reasons, the Architect shall reconsider its determination and shall advise the Contractor of its determination upon such review. If the Architect still finds that such proposed Subcontractor does not meet the requirements above stated, it shall advise the Contractor. The Architect's determination upon such

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review shall be final and binding on the Contractor and its proposed Subcontractor and the Contractor hereby waives any and all claims it or its proposed Subcontractor might have against the Owner, the Construction Manager and/or the Architect concerning the rejection of such Contractor and shall require its Subcontractors to execute such similar waiver in its agreement with the Contractor.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner, Construction Manager or Architect makes reasonable objection to such substitution.

§ 5.2.5 The Maintenance of the Project Schedule is critical. Time is of the essence for this Project. The Contractor shall award subcontracts to entities capable of performing in a manner that will maintain the Project Schedule and require its subcontractors to complete their work in accordance with the Project Schedule.

§ 5.2.6 Upon written request from or on behalf of the Owner, the Contractor shall provide to the Owner executed, unredacted copies of all subcontracts, purchase orders or other agreements relating to the Work.

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§ 5.3 Subcontractual Relations

§ 5.3.1 By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner, Construction Manager and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner, Construction Manager and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors. Each subcontract shall contain provision for execution of lien waivers in form and substance acceptable to the Owner as a condition of payment by the Contractor. The Contractor shall require each Subcontractor to (1) inspect the Project site, including all relevant surfaces and job conditions, before beginning the Work and (2) accept or cite necessary corrections in the Project site, including surfaces or job conditions, before beginning the Work.

§ 5.3.2 The Contractor shall promptly notify the Owner and Architect of any material defaults by any Subcontractor and whether it has terminated its agreement with any of its Subcontractors for any reason.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner pursuant to Article 14 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 90 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor Contractor or other entity. If the Owner assigns the subcontract to a successor Contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor Contractor's obligations under the subcontract.

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§ 5.4.4 All subcontracts over $10,000 shall be in writing with copies of the written subcontract provided to the Owner promptly upon request.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction with Own Forces and to Award Other Contracts

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, which include persons or entities under separate contracts not administered by the Construction Manager, and to award other contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation.

§ 6.1.2 When the Owner performs construction or operations with the Owner's own forces or Separate Contractors, the Owner shall provide for coordination of such forces and Separate Contractors with the Work of the Contractor, who shall cooperate with them.

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§ 6.1.3 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.1.4 The Contractor accepts assignment of, and liability for, all purchase orders and other agreements for procurement of materials and equipment that are identified as part of the Contract Documents. The Contractor shall be responsible for such pre-purchased items, if any, as if the Contractor were the original purchaser. The Contract Sum includes, without limitation, all costs and expenses in connection with delivery, storage, insurance, installation and testing of items covered in any assigned purchase orders or agreements. All warranty and correction of the Work obligations under the Contract Documents shall also apply to any pre-purchased items, unless the Contract Documents specifically provide otherwise.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor recognizes and acknowledges that the Project is governed by and subject to the provisions of New York State General Municipal Law §101, et seq., governing the award of contracts on public improvement projects. As such, the Contractor recognizes and acknowledges that other Contractors or Separate Contractors will be performing work on the project in conjunction with it. As such, the Contractor shall afford the Owner's own forces and other Contractors or Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.1.1 The Contractor shall not commit or permit any act which will interfere with the performance of the work of any other Contractor or Separate Contractor performing work on the Project. If the Contractor sustains any damage through any act or omission of Separate or other Contractors having a contract with the Owner for the performance of work upon the site or of work which may be necessary to be performed for the proper execution of the work to be performed hereunder, or through any act or omission of a subcontractor of such Separate or other Contractor, the Contractor shall promptly notify the Owner and the Construction Manager of such damage

§ 6.2.1.2 The Contractor agrees to defend and indemnify Owner, Architect, Construction Manager, Consultants and Sub-consultants, from all claims made against any of them arising out of the Contractor's acts or omissions or the acts or omissions of any subcontractor of the Contractor which have caused damage to the Owner, Architect, Construction Manager, Separate Contractor or other Contractor on the project. The Owner's right to indemnification hereunder shall in no way be diminished, waived or discharged, or by the exercise of any other remedy provided for by the contract or by law. Further, the Owner shall withhold from the Contractor's Contract Sum an amount sufficient to cover such damage and all expenses and costs associated with the damage sustained.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner's own forces, Separate Contractors or other Contractors, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Construction Manager and Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor or other Contractors that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the

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Construction Manager and the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's or other Contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner, Separate Contractors or other Contractors that are not apparent.

§ 6.2.2.1 The Contractor shall promptly correct discrepancies or defects in its Work identified by Separate Contractors as affecting proper execution and results of the work of the Separate Contractors.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs, including costs that are payable to a Separate Contractors or to other Contractors, because of the Contractor's delays, improperly timed activities or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction, or to property of the Owner, Separate Contractors, or other Contractors as provided in Section 10.2.5.

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§ 6.2.5 The Owner, Separate Contractors, and other Contractors shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.2.6 Should the Contractor or its Subcontractors cause damage to the work or property of any Separate Contractor or other Contractor, the Contractor shall, upon due notice, promptly attempt to settle by agreement or otherwise resolve the dispute with the Separate Contractor or other Contractor. If such separate trade contractor or other Contractor sues or makes any other claim against the Owner, Construction Manager, or Architect on account of any damage alleged to have been caused by the Contractor or its Subcontractors, the Contractor shall defend, indemnify, and hold harmless the Owner, Construction Manager, and Architect against such claim or proceedings at the Contractor's own expense. The Owner's right to indemnification hereunder shall in no way be diminished, waived or discharged, or by the exercise of any other remedy provided for by the Contract Documents or by law. Further, the Owner shall be entitled to withhold from the Contractor's Contract Sum an amount sufficient to cover such damage and all expenses and costs associated with the damage sustained.

§ 6.2.7 When the Work of the Contractor or its Subcontractors overlap or dovetail with that of other Contractors, materials shall be delivered and operations conducted to carry on the Work continuously, in an efficient, workmanlike manner.

§ 6.2.8 In case of interference between the operations of the Contractor and other Contractors, the Construction Manager will be the sole judge of the rights of each contractor and shall have the authority to decide in what manner the Work may proceed, and in all cases its decision shall be final. Any decision as to the method and times of conducting the Work or the use of space as required in this paragraph shall not be basis of any claim for delay or damages by the Contractor.

§ 6.2.9 The Contractor, including its Subcontractors, shall keep itself informed of the progress of other Contractors and shall notify the Architect or the Construction Manager immediately in writing of lack of progress on the part of other Contractors where such delay will interfere with its own operations. Failure of the Contractor to keep informed of the work progressing on the Project and failure to give notice of lack of progress by others shall be construed as acceptance by the Contractor of the status of the work as being satisfactory for proper coordination with the Contractor's Work.

§ 6.2.10 Delays or oversights on the part of the Contractor or its Subcontractors in getting any or all of the Work done in the proper way, thereby causing cutting, removing and replacing Work already in place, shall not be the basis for a claim for extra compensation.

§ 6.2.11 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner, Separate Contractor or other Contractor, the Contractor shall, prior to proceeding with that portion of its Work, promptly report to the Architect and Construction Manager apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor to report such condition shall constitute an acknowledgment that the Owner's, Separate Contractor's or other Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work.

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§ 6.2.12 The Contractor shall promptly correct discrepancies or defects in its Work which have been identified by Separate Contractor(s) or other Contractor(s) as affecting proper execution and results of the work of such Separate Contractor(s) or other Contractor(s).

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, other Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Construction Manager, with notice to the Architect, will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, only by Change Order, Construction Change Directive or field order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents. The Owner may in its sole discretion deduct or reduce the scope of the Contractor's Contract with or without any specific reasons therefor.

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§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Construction Manager, Architect and Contractor; a Construction Change Directive requires agreement by the Owner, Construction Manager and Architect and may or may not be agreed to by the Contractor; a field order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.2.1 Field orders are an interpretation of the Drawings or Specifications which order minor changes in the Contractor's work which will not result in an increase or decrease in the Contract Sum. From time to time, the Architect may issue field orders to the Contractor. The work included in such field order shall be performed by the Contractor at no additional cost to the Owner and shall not form the basis for a claim for an extension of the Contract Time. Hence, the Contractor shall perform the work included in field orders so as to cause no delay to its Work or the work of other Contractors or Separate Contractors engaged by the Owner in connection with the Project. All field orders shall be given to the Contractor and the Construction Manager by the Architect in writing.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or field order for a minor change in the Work. Additional work performed without authorization of a Change Order will not entitle the Contractor to an increase in the Contract Sum or an extension of the Contract Time. No course of conduct or prior dealings between the parties, nor express or implied acceptance of alterations or additions to the Work, and no claim that the Owner has been unjustly enriched by any alteration or addition to the Work, whether or not there is, in fact, any unjust enrichment of the Owner, shall be the basis for any claim to an increase in any amounts due under the Contract Documents or a change in any time period provided for in the Contract Documents. No amount shall be payable by the Owner to the Contractor for performance of work without a written and fully executed Change Order.

§ 7.1.4 Costs for changes in the Work shall not be allowed in excess of usual rentals charged in the area where the Project is located for similar equipment of like size and condition, including costs of necessary supplies and repairs for operating equipment on site in connection with other work unless its use incurs actual and additional costs to Contractor. If equipment not on Site is required for change in work only, cost of transporting equipment to and from Site will be allowed.

§ 7.1.5 When the Owner or Architect (in association with the Construction Manager) request that the Contractor perform work which is not included in the Contract Drawings or Specifications and which will result in additional cost to the Owner, the Architect shall issue a PCO number and shall request that the Contractor submit its proposal for performing such additional work. The Contractor shall submit its proposal to the Construction Manager and Architect for review. The Contractor's proposal shall include a complete itemization of the costs associated with performing its work including labor and materials. All proposals for any work that a Contractor, its Subcontractor(s) or Sub-subcontractor(s) perform in connection with additional work shall be properly itemized and supported by sufficient substantiating data, including but not limited to material descriptions, material quantities, material unit prices, labor trade listings, labor hour quantities, labor trade rates, equipment descriptions and equipment rates with a percentage allowance for overhead and profit as set forth in Section 7.3.11.

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1.	Materials (Itemized Breakdown) including quantities and cost	
2.	Labor (Itemized Breakdown)	
3.	Subtotal (Add lines 1 and 2)	
4.	Credit for Work not required due to additional or changes to the Work reflected in the within change order (if any)	
5.	Overhead (10% x line 3)	
6.	Subtotal (Add lines 3 through 5)	
7.	Subcontract Work (Include itemized breakdown. Subcontractor's overhead and profit allowed is 10%)	
8.	Subtotal (Add lines 6 and 7)	
9.	Profit (5% x line 8)	
10.	Subtotal (Add lines 8 and 9)	
11.	Rental Value of Equipment (Itemized Breakdown)	
12.	Actual additional charges for bonds	
13.	TOTAL CHANGE ORDER (Add lines 10, 11 and 12)	

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§ 7.1.6 Overtime, when specifically authorized by the Owner in writing, and not as a corrective measure by the Contractor to expedite the progress of construction as ordered by the Owner based on its determination that the performance of the Work has not progressed to the level of completion required by the approved Schedule, shall be paid for by the Owner on the basis of premium payment only, plus the cost of insurance and taxes based on the premium payment period. Overhead and profit will not be paid by the Owner for overtime.

§ 7.1.7 Unit prices shall be submitted in the Bid Form for various items as set forth therein, and are subject to approval and acceptance by the Owner. The Owner reserves the right to reject any unit price which is unreasonable or unbalanced, as compared with prevailing costs, or as compared with the unit prices submitted by other bidders for the Project. Approved unit prices quoted shall include all profit, overhead, bonds, insurance, labor, materials, equipment, tools, applicable taxes necessary to complete the work item and shall apply to all work added or work deducted.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Construction Manager and signed by the Owner, Construction Manager, Architect, and Contractor, stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.2.1.4 Changes in the Work involving additional Work or deletion of Work effecting an addition to or subtraction from the Contract Sum shall not be made until the Contractor submits to the Architect and Construction Manager the cost of the added or deleted Work with a complete and detailed listing of all Subcontractors involved, all materials, labor, overhead and profit and an appropriate Change Order has been issued. If requested, the Contractor shall submit detailed quotations for Subcontractors and material suppliers. Changes in the Work when not involving additions or deletions from the Contract Sum shall not be made until the Architect has issued an appropriate Change Order. All Change Orders must have the approval of the Owner, Construction Manager and Architect in writing.

§ 7.2.2 Methods used in determining adjustments to the Contract Sum may include those listed in Section 7.3.3.

§ 7.2.3 Agreement on any Change Order shall constitute a final settlement of all Claims and other matters related to the change in Work that is the subject of the Change Order, including, but not limited to, all direct and indirect costs associated with such change (including, without limitation, all costs of associated delay, interference, acceleration,

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inefficiency, overhead, as well as costs of material, labor and supervision), and any and all adjustments to the Contract Sum and the Contract Time. Payment of a Change Order shall constitute accord and satisfaction of all Claims of the Contractor in connection with the change or changes to the Contract addressed by the Change Order and it is understood and agreed that a signed Change Order shall be the complete and fully integrated agreement for all related costs and there are no oral or written understandings, reservations, representations or agreements, directly or indirectly, connected with the Change Order and not affirmatively stated on the signed Change Order. In the event a Change Order increases the Contract Sum, the Contractor shall include the Work covered by such Change Orders in Applications for Payments as if such Work were originally part of the Contract Documents.

§ 7.2.4 Upon the Contractor's completion of the Change Order work, and prior to payment being made to the Contractor for such work, the Contractor shall provide the Owner with the following information:

.1 Certified payrolls itemizing the labor actually utilized in connection with the Change Order work; and

.2 Copies of invoices from its Subcontractors supplying work in connection with the Change Order work.

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§ 7.2.5 Additional work performed without authorization of a Change Order will not entitle the Contractor to an increase in the Contract Sum or an extension of the Contract Time, except at provided in Section 7.3, and except in the case of an emergency as provided in Section 10.4.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Construction Manager and signed by the Owner, Construction Manager and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order. In the event the Contractor and the Owner cannot agree on the sum by which the Contract Sum or the amount of time by which the Contract Time is to be increased or reduced based upon changes to the scope of the Work as described in Article 7, the Architect or Construction Manager shall issue a Construction Change Directive reflecting the increase or reduction of the scope of the Contractor's Contract.

§ 7.3.2.1 If the Owner and the Contractor cannot agree that the requested Work properly forms the basis for a Change Order or on the sum by which the Contract is to be increased or reduced based upon changes to the scope of Work, the Architect or Construction Manager shall issue a Construction Change Directive signed by the Owner, Construction Manager and Architect reflecting the addition to, or deduction of, the scope of Work and the Contractor shall (a) in the case of additional work to be performed by the Contractor, perform such additional work in an expeditious manner so as not to delay the Work of the Contractor or other Contractors working at the site and keep records of its performance of such additional work, and (b) in the case of work to be deducted from the scope of the Contractor's Work, refrain from taking any steps in connection with the work associated with the deduction of the Contractor's Work. The Construction Change Directive shall include: (a) a description of the work being added or deducted from the Contractor's scope of Work; (b) the amount the Owner has determined to be the cost associated with the additional work or deduction of the scope of the Contractor's Contract until the Owner and the Contractor agree upon the increase or decrease in the Contractor's Contract Sum, or until a claim filed by the Contractor has been determined; and (c) the extent to which the Contract Time will be adjusted as a result of the change in the scope of Work. Any claims must be filed in accordance with the requirements set forth in Article 15 of these General Conditions. Failure to timely file any claim in accordance with requirements set forth therein shall constitute a waiver of such claim.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

.2 Unit prices stated in the Contract Documents or subsequently agreed upon (unit prices shall be deemed to include all costs and expenses for the Contractor's changed Work, including costs of general conditions, insurance/bonds and overhead and profit attributable to the change);

.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee subject to the limitations of Section 7.3.11; or

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.4 As provided in Section 7.3.4 subject to the limitations of Section 7.3.11.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Construction Manager shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.11, the Contractor shall keep and present, in such form as the Construction Manager may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Actual costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers compensation insurance. Labor rates shall be calculated based only on the worker's actual base wage rate and those payroll burdens which the Contracts (or Subcontractor) is obligated to and does pay for labor in connection with the change. Labor rates shall not include any amount for overhead type expenses, including, but not limited to, charges for home office costs, management supervision, training, vehicles and pickups, travel, reproduction, temporary facilities, computers, office equipment, small tools, expendables, safety, etc.;

.2 Actual costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed. Sales taxes, if any are required, shall be indicated and added after the cost of the change is calculated. No overhead or profit will be paid on sales tax;

.3 Actual rental costs of machinery and equipment, exclusive of hand tools, rented from third parties; and

.4 Actual costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the additional work. The Contractor shall submit with its proposal actual invoices from its insurance broker reflecting actual additional costs associated with the procurement of bonds and insurance.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Construction Manager of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time. Any claims must be filed in accordance with the requirements set forth in Article 15 of these General Conditions. Failure to timely file any claim in strict accordance with requirements set forth therein shall constitute a waiver of such claim.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 When the Owner or Architect request that portions of the Contractor's Work originally included in the Drawings or Specifications be deleted and which will result in a reduction of the Contract Sum, the Architect shall request that the Contractor submit its proposal for deleting the scope of such Work from the Contract. The Contractor's proposal shall include a complete itemization of the costs associated with deducting such work including labor and materials and shall be submitted using the format set forth in Section 7.1.5 or the schedule of values, whichever is greater. The Contractor shall not be entitled to retain its overhead and profit for such work nor shall any of its subcontractors which were to perform the work being deducted from the Contractor's scope of Work. Additionally, the Contractor shall reflect the reduced cost of premiums on bonds which are to be supplied herein as a result of such change. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Construction Manager and Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Construction Manager and Architect determine to be reasonably justified. The interim determination of cost shall adjust the Contract Sum on the same

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basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Construction Manager and Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Construction Manager shall prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.3.11 The limit for the combined overhead and profit included in the total cost to the Owner shall be based on the following schedule:

- **.1** For the Contractor, for Work performed by the Contractor's own forces, fifteen percent (15%) of the direct cost for labor and materials.
- **.2** For the Contractor, for Work performed by the Contractor's Subcontractor, maximum of five percent (5%) of the amount due the Subcontractor for the Contractor's overhead and profit. For the Subcontractor, for Work performed by the Subcontractor's own forces, ten percent (10%) of the direct cost for labor and materials. The total combined overhead and profit for a change order shall be limited to 15% of the direct cost regardless if the Work is performed by the Contractor or the Subcontractor.
- **.3** The markup on any part of the Work a Subcontractor subcontracts will be limited to one overhead and profit figure, in addition to the Contractor's overhead and profit markup. The Subcontractor and Sub-subcontractor may divide the overhead and profit amount as they agree upon.
- **.4** Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.4.
- **.5** In order to facilitate checking of quotations for extras and credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials, and subcontracts. Labor and material shall be itemized in the manner prescribed above. Where major cost items are subcontracts, they shall be itemized also.
- **.6** Overhead and profit mark-up shall include, but not be limited to, the following:
  - **.1** home office expense;
  - **.2** field office expense;
  - **.3** supervision;
  - **.4** project management & estimation; and
  - **.5** small tools & equipment.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Construction Manager and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Construction Manager that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement. The date shall not be postponed or extended by the failure to act of the Contractor or persons or entities for whom the Contractor is responsible to act.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8. The date of final completion is the date certified by the Architect and Owner in accordance with Section 9.10. Unless otherwise agreed in writing by the Owner, the Contractor agrees that final completion shall occur not more than 30 calendar days after the date of Substantial Completion.

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§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.1.5 Work remaining to be completed after Substantial Completion, shall be limited to items which can ordinarily be completed within a thirty (30) day period (one month) before final payment is made.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not commence Work on the site until two certified copies of all insurance policies and bonds required by Article 11 of these General Conditions are provided to the Owner and accepted by the Owner. The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor. The date of commencement of the Work shall not be changed by the effective date of such insurance. The Work can not start until required insurance and bonds are provided and the Contract has been executed.

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§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion and final completion within the Contract Time. The Contractor agrees that the Work shall be prosecuted regularly, diligently and uninterruptedly at such rate of progress as will insure full completion thereof within the Contract Time specified and, further, to provide such protections as may be necessary. It is expressly understood and agreed by the Contractor that the time for the substantial and final completion of the Work is a reasonable time for its completion, taking into consideration, among other things, the average climatic range and usual weather conditions prevailing in the Project's locality.

§ 8.2.4 In no case shall the Contractor delay the progress of the Work, or any part thereof, on account of changes in the Work or disputes caused by proposed or ordered changes in the Work (including the equitable value of the changes), or any disputes or disagreements as to the Work or extra work.

§ 8.2.5 The Contractor recognizes that achieving Substantial Completion and final completion of the Work in accordance with the time limits set forth in the Agreement and as further set forth in the Milestone Schedule provided in the Project Manual are material conditions of this Agreement, and that if the Contractor fails to achieve Substantial Completion and final completion of the Work in accordance with such schedule, the Owner will incur damages as a result. The Owner and Contractor agree that the amount of such damages is difficult to ascertain with any precision. The Contractor and Owner have attempted to estimate reasonable daily figures for liquidated damages, not to penalize the Contractor for late completion, but to reasonably estimate probable losses and damages to the Owner in the event of the late completion. If the Contractor does not achieve the completion date and milestone date for each Work item in the Contract, a milestone or critical path date reflected on the Project Schedule, or the date of Substantial Completion or final completion for the Work or any part thereof, liquidated damages will be assessed in the amount of $1,000.00 for each and every calendar day after such time allowed for completion until Substantial Completion or final completion actually occurs.

§ 8.2.5.1 The Contractor realizes that time is of the essence on this Contract and the Substantial Completion date and final completion date for each Work item in its Agreement, a milestone date reflected on the Project Schedule, or the date of Substantial Completion or final completion of the Contractor's Work shall be no later than the date indicated therein. In the event the Contractor fails to complete any Work or substantially complete the Work by said schedule date, the sum per calendar day for each date not met, as delineated above, will be subtracted from the payment due the Contractor (or, if the amount due Contractor as payment is insufficient, any deficiency shall be paid by the Contractor to the Owner), except in cases where the Contractor has applied for and been granted an extension of the Contract Time in accordance with the provisions of the Contract Documents.

§ 8.2.5.2 The said sum per calendar day shall constitute the liquidated damages incurred by the Owner for each day of delay beyond the agreed upon dates of Substantial Completion or final completion. The foregoing liquidated damages are intended to compensate the Owner only for the loss of beneficial use of the Work of the Contract. In the event the Contractor fails to complete all Work under this Contract by said scheduled dates, in addition to the liquidated damages incurred by the Owner in connection with the Contractor's delay, to the fullest extent permitted by law, the Contractor shall be liable for all costs incurred by the Owner for additional services provided by the

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Architect and Construction Manager, as well as liabilities to other Contractors and Separate Contractors working on the Project.

§ 8.2.5.3 The Owner's right to liquidated damages shall survive abandonment of the Work by the Contractor or the Owner's termination of the Contract.

§ 8.2.5.4 Notwithstanding the foregoing, if one or more of the liquidated damages provisions set out in the Agreement are held to be legally unenforceable as a penalty, the Owner shall be allowed to recover actual damages caused by the Contractor's failure to achieve the applicable Contract Time requirements.

§ 8.2.6 If the Contractor does not achieve Substantial Completion and final completion within the Contract Time established in the Notice to Proceed and acknowledged in the Agreement between the Owner and Contractor, the Contractor shall be responsible for the cost of reimbursement of the Owner for payments made to the Architect and Construction Manager for services rendered by either of them from the end of the Contract Time established in the Notice to Proceed until Substantial Completion and final completion are achieved. If the Owner is required to pay the Architect or the Construction Manager in accordance with its agreements with each of them, the Owner will back-charge the Contractor.

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§ 8.2.7 In the event the Contractor fails to complete all Work under this Contract by said scheduled dates, the Contractor will not be permitted to perform any work during normal school hours. Such work shall only be performed after school hours, Saturdays, Sundays, holidays or periods when school is unoccupied at no additional cost of any kind to the Owner. In addition to damages incurred by the Owner in connection with the Contractor's delay, the Contractor shall be liable for all costs incurred by the Owner to provide staff, Architect and Construction Manager personnel as required to make facility accessible by Contractor and perform inspections during such off hours.

§ 8.2.8 The Contractor understands that in order to meet the requirements of the Project Schedule, including intermittent milestone and critical path dates set forth in the Contract Documents, it may be required to work its personnel and equipment overtime on regular workdays and on Saturdays and holidays, the cost of which is included in the Contract Sum. If the Owner specifically approves in writing reimbursement for overtime, the Contractor shall be paid by the Owner on the basis of the premium payment.

§ 8.2.9 The Owner shall have the right at any time to modify the Project Schedule; to suspend, delay or accelerate, in whole or in part, the commencement or execution of the Work or any potion thereof or to vary the sequence thereof; and to prescribe the time, order and priority of the various portions of the Work, and all other matters relating to the scheduling of the Work. The Contractor shall not be entitled to additional compensation for any such decisions made by the Owner.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed in the commencement or progress of the Work as a result of: Acts of God (such as tornado, flood, hurricane, pandemics, epidemics, etc. making performance temporarily impossible); the negligent acts or omissions of the Owner, Architect, Construction Manager, other Contractors, or their agents or employees; strikes, lockouts or other labor disturbances (not arising from the labor practices of the Contractor or its Subcontractors, Suppliers, or Sub-subcontractors to comply with their obligations arising under the Contract); unusually adverse weather conditions; freight embargoes (provided that delays by the Contractor, its Subcontractors, Sub-subcontractors or Suppliers do not constitute an excusable cause of delay); changes in the work to be performed by the Contractor (not caused or resulting from the failure of the Contractor or its Subcontractors, Suppliers or Sub-subcontractors); by delay authorized by the Owner pending mediation and binding dispute resolution; or changes to laws or regulations after the effective date of the Contract; provided the Contractor has used all reasonable efforts to mitigate the foregoing causes; then the Contractor shall be entitled to a day for day extension of the Contract Time for the established delay to the critical path of the Work subject to the provisions of this Article 8 and Article 15. All other delays of the Project, including but not limited to: Architect review or approval of shop drawings, other submittals, requests for information, clarifications, samples, and change orders; the Owner's schedule; Architect or Construction Manager certification of payment; payment by the Owner of Contractor's Application for Payment; coordination among the Multiple Prime Contractors; unavailability of materials or equipment; surveying/testing; closeout, etc. are deemed to be foreseeable and contemplated and, therefore shall not form the basis for a claim for an extension of time or additional compensation by the Contractor. The extension of time provided under this Section 8.3.1 shall be the Contractor's exclusive remedy.

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§ 8.3.1.1 The Contractor further acknowledges and agrees that adjustments in the Contract Time will be permitted for a delay only to the extent such delay (1) is not caused or could not have been anticipated by the Contractor, (2) could not be limited or avoided by the Contractor's timely notice to the Owner of the delay or reasonable likelihood that a delay will occur, and (3) is of a duration of more than one (1) day.

§ 8.3.1.2 The Contractor's inability to secure sufficient personnel for the performance of the Work shall not constitute a basis for an extension of time. The Contractor shall not be entitled to an extension of time if the Architect or Construction Manager stops the Work due to the existence of or reasonable suspicion of a deficiency in the Work.

§ 8.3.1.3 An extension of the Contract Time, if requested by the Contractor, shall only be considered after the Contractor has made reasonable effort to recover the lost time. An extension, or extensions, of time may be granted subject to the provisions of this Article 8, but only after written application therefore by the Contractor. An extension of time shall be only for the number of days of delay which the Architect may determine to be due solely to the causes set forth in the application for extension of time. The Contractor shall not be entitled to receive a separate extension of time for each one of several causes of delay operating concurrently; but if at all, only the actual period of delay as determined by the Construction Manager or Architect.

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§ 8.3.1.4 All requests for additional time shall be made in writing, delivered to the Construction Manager within five (5) calendar days from the time when the circumstance with potential for delay becomes reasonably known to the Contractor, supported by documentation which demonstrates to the Architect and Construction Manager's satisfaction that the critical path of the Work has been significantly altered by the delays to the activities in question, and that the schedule cannot be maintained by re-ordering other activities within the Project at no cost. This request shall also contain, at a minimum, the following information: (1) date of start of delay; (2) specific cause of delay; (3) effect of delay on construction progress; and (4) date of termination of delay. Upon receipt of the Contractor's request for an extension of time, the Owner will ascertain the facts and extent of the delay, and may, in its sole discretion, extend the time for completion of the Contractor's Work when in its judgment such an extension is justified. The Owner's determination will be final and binding in any litigation commenced by the Contractor against the Owner which arises out of the Owner's denial of an extension of time to the Contractor. Any approval of an extension of the Contractor's time to complete its Work shall be memorialized by written change order, signed by the Owner, Contractor, Architect and Construction Manager. When the Owner determines that the Contractor will be granted an extension of time, such extension shall be computed in accordance with the following: for each day of delay in the completion of its Work, the Contractor shall be allowed one day of additional time to complete its Contract. The Contractor shall not be entitled to receive a separate extension of time for each one of several causes of delay operating concurrently; rather, only the actual period of delay as determined by the Owner or its Architect may be allowed.

§ 8.3.1.5 Failure of the Contractor to give written notice as required by Section 8.3.1.4 or to strictly comply with the requirements of Article 8 shall be deemed conclusively to be a waiver and release of such claim, and such notice shall be a condition precedent to the Contractor's right to make a claim for any claim arising out of, under or in connection with the Contractor or the performance of the Work.

§ 8.3.2 Notwithstanding anything to the contrary in the Contract Documents, an extension in the Contract Time, to the extent permitted and justified under Section 8.3.1, shall be the sole remedy of the Contractor for, and the Contractor waives its right to any claim for damages to the extent arising from, any (1) delay in the commencement, prosecution, or completion of the Work; (2) hindrance or obstruction in the performance of the Work; (3) loss of productivity or acceleration; or (4) other claims for disruption, interference, inefficiencies, impedance, hindrance, acceleration, resequencing, schedule impacts, lack of timeliness by the Owner or its consultants, and lack of coordination, errors or omissions in the design of the Project, cumulative impact of multiple change orders, delay and other impacts (collective referred to herein as "Delay(s)"). In no event shall the Contractor be entitled to any compensation or recovery of any damages in connection with any Delay, including, but not limited to, delay costs, loss of productivity or efficiency costs, lost profits, extended jobsite general conditions and home office overhead, consequential damages, lost opportunity costs, impact damages, or other similar remuneration. The Owner's exercise of any of its rights or remedies under the Contract Documents (including, but not limited to, ordering changes in the Work, or directing suspension, rescheduling or correction of the Work), regardless of the extent or frequency of the Owner's exercise of such rights or remedies, shall not be construed as interference, hindrance or obstruction with the Contractor's performance of the Work and shall not entitle the Contractor to any additional

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compensation. The Contractor shall include a no-damages-for-delay clause in all subcontracts for the performance of the Work.

§ 8.3.3 Delays that affect the scheduled completion of the Work and are attributable to interference between other Contractors, Separate Contractors, Subcontractors, Suppliers, utility companies or municipalities, shall be compensated solely by the granting of an extension of time to the Contractor by the Owner to complete the Work without charges to the Owner. The parties acknowledge that the Contract Time accounts for and contemplates the time necessary for: review of submittals and shop drawings; correcting design errors or omissions; coordination among the Contractor, other Contractors and Separate Contractors; change orders; delays incurred by seasonal limitations; and other administrative processing by all parties involved and are not compensatory. The Contractor agrees that it has included in its Bid prices the additional cost of doing work under this Contract caused by interference of the Architect, Construction Manager, other Contractors, Separate Contractors, Subcontractors, etc. and the other non-compensatory Delays described above.

§ 8.3.4 When the Contract Time has been extended, as provided under Section 8.3, such extension of time shall not be considered as justifying extra compensation to the Contractor for administrative costs, home office, estimating, extended general conditions or other similar impact costs. The Contractor acknowledges that in agreeing to the Contract Sum it assessed the potential impact of the limitations in Section 8.3.2 on its ability to recover additional compensation in connection with a Work delay, interference, impact or hindrance and agrees that those limitations shall apply regardless of the accuracy of the Contractor's assessment or actual costs incurred by the Contractor.

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§ 8.3.5 If the Contractor submits a progress report indicating, or otherwise expresses an intention to achieve, completion of the Work prior to any completion date required by the Contract Documents or expiration of the Contract Time, no liability of the Owner to the Contractor for any failure of the Contractor to so complete the Work shall be created or implied.

§ 8.3.6 The intent of the Contract is for Work to follow a logical sequence. The Contractor, however, may be required by the Owner, Construction Manager or Architect to temporarily omit or leave out any section of Work or perform Work out of sequence. Out of sequence work and come back time to these areas shall be performed at no additional cost to the Owner.

§ 8.3.7 Claims relating to Contract Time shall be made in accordance with applicable provisions of Article 15.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents. Notwithstanding anything to the contrary contained in the Contract Documents, the Owner may withhold or offset any payment to the Contractor if and for so long as the Contractor fails to perform any of its obligations under any of the Contract Documents; provided, however, that any such holdbacks shall be limited to an amount sufficient in the reasonable opinion of the Owner to cure any default or failure of performance by the Contractor.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

§ 9.2.1 Within ten (10) days of Notice of Award, the Contractor shall submit to the Construction Manager, for review and approval by the Architect and Construction Manager, a schedule of values allocated to various portions of the Work for each building, prepared in the currently authorized form of AIA Document G703 – Continuation Sheet and supported by such data to substantiate its accuracy as the Construction Manager and Architect may require. The schedule of values shall contain each of the CSI division sections reflected in the Specifications and applicable to the Contractor's Work, together with the requirements for bonds/insurance (based upon actual invoice amount), general conditions, meeting attendance and meeting documentation (at least $250 per meeting for a minimum of 50 meetings), shop drawing/product data/sample submissions (at least one (1) percent of Contract Sum), labor and materials on line items as applicable, temporary utilities and services, HVAC balance reports, coordination drawings, punchlist (at least one (1) percent of the contract sum), warranties/guarantees and close out of the Project (at least three (3) percent of the Contract Sum), and allowances, where applicable. This schedule, unless objected to

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by the Architect or the Construction Manager, shall be used as a basis for reviewing the Contractor's applications for payment.

§ 9.2.2 Any schedule of values that fails to include sufficient detail, is unbalanced or exhibits "front loading" of the value of the Contractor's Work will be rejected. Furthermore, if the schedule of values has been approved by the Construction Manager and the Architect and is subsequently used, but later is found by the Construction Manager or Architect to be improper for any reason, sufficient funds shall be withheld from the Contractor's future applications for payment to ensure an adequate reserve (exclusive of normal retainage) to complete the Contractor's Work.

§ 9.2.3 The schedule of values shall be drafted so as to reflect multiple construction sites, multiple locations within each site, additions versus renovations of work, and the like so as to satisfy any New York State Education Department requirements for the Project.

§ 9.3 Applications for Payment

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§ 9.3.1 By the 25th of each month, the Contractor shall submit to the Construction Manager five (5) original itemized Applications for Payment prepared in accordance with the schedule of values, notarized and reflecting retainage as provided elsewhere in the Contract Documents. Applications for Payment will be in the currently authorized form of AIA Document G732 - 2019, "Application and Certificate for Payment," accompanied by AIA Document G703-1992, "Continuation Sheet," and must include (add or deduct) adjustments to the Contract Sum resulting from Work performed under approved change orders (specified under Article 7) and shall be shown separately on the application for previous and current periods. Each Application and Certificate of Payment shall be accompanied by copies of the Pay Application Lien Waiver and Release in the form set forth in the Payment Procedures. Each Application for Payment shall be prepared in such form and supported by such data to substantiate the Contractor's right to payments as the Owner, Construction Manager, and/or Architect may require such as copies of requisitions from Subcontractor and material suppliers. Each Application for Payment forwarded to the Owner by the Construction Manager or the Architect shall be subject to audit and approval by the Owner in accordance with the Owner's normal audit procedures.

§ 9.3.1.1 Each Application and Certificate of Payment shall be accompanied by the following documentation:

- **.1** A current Contractor's lien waiver and duly executed and acknowledged sworn statement showing all Subcontractors and material suppliers with whom the Contractor has entered into subcontracts, the amount of each such subcontract, the amount requested for any Subcontractor and material the Contractor from such progress payment, together with similar sworn statements from all such Subcontractors and material suppliers;
- **.2** Duly executed waivers of public improvement liens from all Subcontractors and material suppliers and lower tiered Subcontractors or material suppliers establishing payment or satisfaction of payment of all amounts requested by the Contractor on behalf of such entities or persons in any previous Application for Payment; and AIA Form G706 or G706A;
- **.3** Certified payroll for employees of the Contractor and employees of Subcontractors performing work on the Project;
- **.4** Copies of invoices submitted to the Contractor by its subcontractors and/or material suppliers; and
- **.5** Such other information which the Owner, Construction Manager and/or the Architect request the Contractor furnish in connection with its Application for Payment.

§ 9.3.1.2 The Construction Manager and Architect shall review the application for payment submitted by the Contractor and shall advise the Contractor of any adjustments to be made thereto. The Construction Manager and/or the Architect may make such adjustments under the circumstances set forth in Section 9.5.1. If any such adjustments are made by the Architect or Construction Manager, the Contractor shall submit five original itemized revised applications each with all documentation required by Sections 9.3.1 and 9.3.1.1.

§ 9.3.1.3 As provided in Section 7.3.9, such Applications may include requests for payment on account of changes in the Work that have been properly authorized by fully executed Construction Change Directives.

§ 9.3.1.4 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier unless such Work has been performed by others whom the Contractor intends to pay.

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§ 9.3.1.5 Until Substantial Completion, the Owner shall pay ninety-five percent (95%) of the amount due the Contractor on account of progress payments, less an amount necessary to satisfy any claims, liens or judgments against Contractor, which have not been suitably discharged. In accordance with Section 9.8.5, the Owner shall pay the entire amount retained from previous progress payments less two (2) times the amount required to complete items identified in a list prepared in accordance with Section 9.8.2 and the amount required to satisfy any outstanding claims, liens, or judgments against the Contractor.

§ 9.3.1.6 In the event the surety bonds identified in Section 11.4 become invalid, the Owner shall pay ninety percent (90%) of the amount of each progress payment due the Contractor until Substantial Completion in accordance with Section 9.3.1.5 above. At the sole discretion of the Owner, the Owner may declare a default by the Contractor pursuant to the terms and provisions of this Contract in the event that the surety bonds identified in Section 11.4 become invalid.

§ 9.3.1.6 The Contractor and its Subcontractors are required to submit certified payroll and OSHA 10 information monthly with Application for Payment to the Owner in accordance with New York State Law.

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§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the Project site for subsequent incorporation in the Work. If approved in advance in writing by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest. The costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site shall not increase the Contract Sum.

§ 9.3.2.1 Payment may be made for materials and equipment delivered and suitably stored on-site for future incorporation in the Work, subject to the following conditions:

.1 Request for payment shall be considered for material or equipment, which is in short or critical supply, which has been specially fabricated for the Project or, at the discretion of the Construction Manager and Architect, for other materials or equipment.

.2 A request for payment of material stored on-site must be made by the Contractor ten (10) days prior to actual, monthly cut-off date for Payment Applications.

.3 Procedures required by the Owner shall include, but not necessarily limited to, submission by the Contractor to the Construction Manager and Architect of bills of sale and bills of lading for such materials and equipment, provisions of opportunity for the Construction Manager's and Architect's visual verification that such materials and equipment are in fact in storage; and, if stored off-site, submission by the Contractor of verification that such materials and equipment are stored in a bonded warehouse.

.4 All such materials and equipment, including materials and equipment stored on-site but not yet incorporated into the Work, upon which partial payments have been made shall become the property of the Owner, but the care and protection of such materials and equipment shall remain the responsibility of the Contractor until incorporation into the Work and accepted by the Owner at substantial completion, including maintaining insurance coverage on a replacement cost basis without voluntary deductible.

§ 9.3.2.2 Payment may be made for materials and equipment delivered and suitably stored off-site for future incorporation in the Work, subject to the following conditions:

.1 The Contractor shall submit: a written validation by the Owner, Construction Manager or Architect that such materials are stored safely off site, in the quantities and condition stated by the Contractor; a copy of an invoice for the material and equipment; a bill of sale or equivalent indication of the quantity and value of the material or equipment; a written statement indicating the location and method of storage; and property insurance certificate or rider covering the specific material or equipment, which shall name the Owner as an additional insured party.

.2 The Contractor shall submit a verification that such materials and equipment are stored in a bonded warehouse.

.3 A request for payment of material stored off-site must be made by the Contractor ten (10) days prior to actual, monthly cut-off date for Payment Applications.

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.4 All such materials and equipment upon which partial payments have been made shall become the property of the Owner, but the care and protection of such materials and equipment shall remain the responsibility of the contractor until incorporation into the Work and accepted by the Owner at substantial completion, including maintaining insurance coverage on a replacement cost basis without voluntary deductible.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.3.4 The Contractor further expressly undertakes to defend the Indemnitees (as defined previously in Section 3.18), at the Contractor's sole expense, against any actions, lawsuits or proceedings brought against Indemnitees as a result of liens filed against the Owner, the Work, the site of any of the Work, the Project site and any improvements thereon, payments due the Contractor or any portion of the property of any of the Indemnities (referred to collectively as liens in this Section 9.3.4). The Contractor hereby agrees to defend, indemnify and hold Indemnitees harmless against any such liens or claims of lien and agrees to pay any judgment or lien resulting from any such actions, lawsuits or proceedings.

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§ 9.3.5 The Owner shall release any payments withheld due to a lien or a claim of lien if the Contractor obtains security acceptable to the Owner or a lien bond which is: (1) issued by a surety acceptable to the Owner, (2) in form and substance satisfactory to the Owner, and (3) in an amount not less than One Hundred Fifty percent (150%) of such lien claim. By posting a lien bond or other acceptable security, however, the Contractor shall not be relieved of any responsibilities or obligations under this Section 9.3, including, without limitation, the duty to defend and indemnify the Indemnities in an action on the lien, lien discharge bond or underlying debt. The cost of any premiums incurred in connection with such bonds and security shall be the responsibility of the Contractor and shall not be part of, or cause any adjustment to, the Contract Sum.

§ 9.4 Certificates for Payment

§ 9.4.1 The Construction Manager will, within seven (7) days after the Construction Manager's receipt of the Contractor's Application for Payment, review the Application, certify the amount the Construction Manager determines is due the Contractor, and forward the Contractor's Application and Certificate for Payment to the Architect. Within seven (7) days after the Architect receives the Contractor's Application for Payment from the Construction Manager, the Architect will either issue to the Owner a Certificate for Payment, with a copy to the Construction Manager, for such amount as the Architect determines is properly due, or notify the Construction Manager and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1. The Construction Manager will promptly forward to the Contractor the Architect's notice of withholding certification.

§ 9.4.2 Where there is more than one Contractor performing portions of the Project, the Construction Manager will, within seven (7) days after the Construction Manager receives all of the Contractors' Applications for Payment: (1) review the Applications and certify the amount the Construction Manager determines is due each of the Contractors; (2) prepare a Summary of Contractors' Applications for Payment by combining information from each Contractor's application with information from similar applications for progress payments from the other Contractors; (3) prepare a Project Application and Certificate for Payment; (4) certify the amount the Construction Manager determines is due all Contractors; and (5) forward the Summary of Contractors' Applications for Payment and Project Application and Certificate for Payment to the Architect.

§ 9.4.2.1 Within seven (7) days after the Architect receives the Project Application and Project Certificate for Payment and the Summary of Contractors' Applications for Payment from the Construction Manager, the Architect will either (1) issue to the Owner a Project Certificate for Payment, with a copy to the Construction Manager; or (2) issue to the Owner a Project Certificate for Payment for such amount as the Architect determines is properly due, and notify the Construction Manager and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Project Application for Payment, and notify the Construction Manager and Owner of the Architect's reason for withholding certification in whole as provided in

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Section 9.5.1. The Construction Manager will promptly forward the Architect's notice of withholding certification to the Contractors.

§ 9.4.3 The Construction Manager's certification of an Application for Payment shall be based upon the Construction Manager's evaluation of the Work and the information provided as part of the Application for Payment. The Construction Manager's certification will constitute a representation that, to the best of the Construction Manager's knowledge, information and belief, the Work has progressed to the point indicated and the quality of the Work is in accordance with the Contract Documents. The certification will also constitute a recommendation to the Architect and Owner that the Contractor be paid the amount certified.

§ 9.4.4 The Architect's issuance of a Certificate for Payment shall be based upon the Architect's evaluation of the Work, the recommendation of the Construction Manager, and information provided as part of the Application for Payment. The Architect's certification will constitute a representation that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated, that the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified.

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§ 9.4.5 The representations made pursuant to Sections 9.4.3 and 9.4.4 are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Construction Manager or Architect.

§ 9.4.6 The issuance of a separate Certificate for Payment or a Project Certificate for Payment will not be a representation that the Construction Manager or Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed the Contractor's construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Construction Manager or Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Construction Manager's or Architect's opinion the representations to the Owner required by Section 9.4.4 and 9.4.5 cannot be made. If the Construction Manager or Architect is unable to certify payment in the amount of the Application, the Construction Manager will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor, Construction Manager and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Construction Manager or Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Construction Manager's or Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from the acts and omissions described in Section 3.3.2 because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner, other Contractor or a Separate Contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;
- **.7** failure to carry out the Work in accordance with the Contract Documents;
- **.8** receipt by the Owner of a notice of withholding from the New York State Department of Labor or other administrative agencies having jurisdiction over the Project;
- **.9** failure to comply with applicable federal, state or local statutes, regulations, or laws, including, without limitation, laws and regulations applicable to the provision of certified payrolls;
- **.10** failure of the Contractor to provide executed performance and payment bonds and a current certificate of insurance and endorsements;
- **.11** reasonable evidence that the Work has not progressed as indicated on the Application for Payment;

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.12 damages caused to the Owner, Construction Manager, the Architect or other Contractor as a result the Contractor's performance of its Work;
.13 the Architect's or the Construction Manager's discovery or observation of work which has been previously paid for by the Owner which is defective or incomplete;
.14 The amount requested exceeds the percent completion of Work on the site; or
.15 breach of this Agreement.

Notwithstanding the extent to which the Construction Manager or Architect certify an Application for Payment, the Owner shall have the right to withhold payment, in whole or in part, should the Owner determine that any of the grounds for withholding certification set forth in this Section 9.5.1 do in fact exist. If the Owner withholds payment, in whole or in part, the Owner shall promptly provide to the Contractor, Architect and Construction Manager a written explanation of the reason(s) for which payment is withheld and shall promptly pay, in accordance with the Contract Documents, all amounts which are not in dispute.

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§ 9.5.2 When the above reasons for withholding certification or the Owner's withholding of payment are removed, certification will be made for amounts previously withheld.

§ 9.5.3 If the Contractor disputes any determination by the Owner, Construction Manager or Architect with regard to any Certificate for Payment, or in the event of a bona fide dispute between the Contractor and the Owner, the Contractor nevertheless shall expeditiously continue to prosecute the Work and may submit a Claim in accordance with Article 15.

§ 9.5.4 If the Architect or Construction Manager withholds certification for payment under Section 9.5.1, or if the Owner otherwise deems it necessary to protect its interests or the interests of the Project, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Construction Manager and both will reflect such payment on the next Certificate for Payment.

§ 9.5.5 Notwithstanding anything above to the contrary, the Owner has the right to withhold payment to the Contractor to protect itself against damages incurred or which may be incurred as a result of the Contractor's breach or negligence, including, but not limited to, the items set forth in Section 9.5.1. With respect to any liens, claims, or other circumstances for which the Owner is entitled to withhold payments pursuant to decisions by the Architect pursuant to Section 9.5.1, the Owner shall be entitled to withhold a sum equal to twice the stated amounts of such liens or claims, or, where there is no stated amount, twice the amount determined by the Architect to be necessary to protect the interests of the Owner. The Owner will release payments withheld due to liens provided that the Contractor obtains a discharge of record of such lien, by bonding or otherwise. By posting a lien discharge bond, however, the Contractor shall not be relieved of any responsibilities or obligations under the Agreement, including, without limitation, the duty to defend, indemnify, and hold harmless the Indemnitees (as defined previously in Section 3.18). The cost of any premiums or other expenses incurred in connection with such bonds or other means of discharge of record shall be the sole responsibility of the Contractor and shall not be part of, or cause any adjustment to, the Contract Sum.

§ 9.5.6 If the Owner is entitled to reimbursement or payment from the Contractor under or pursuant to the Contract, including but not limited to these General Conditions, such payment shall be made promptly upon demand by the Owner. Notwithstanding anything contained herein to the contrary, if the Contractor fails to promptly make any payment due the Owner, or the Owner incurs any costs and expenses to cure any default of the Contractor or to correct defective work, the Owner shall have an absolute right to offset such amount against the Contract Sum and may, in the Owner's sole discretion, elect either to: (1) deduct an amount equal to that which the Owner is entitled from any payment then or thereafter due the Contractor from the Owner, or (2) issue a written notice to the Contractor reducing the Contract Sum by an amount equal to that which the Owner is entitled.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents unless such requisition is not in accordance with the terms of the Contract Documents, and shall so notify the Construction Manager and Architect.

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§ 9.6.2 Payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held in trust by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contracts with the Contractor for which payment was made by the Owner. The Contractor shall strictly comply with any common law, statutory, or decisional law trust fund requirements in the State of New York (including, without limitation, the requirements of New York Lien Law Article 3-A), and hereby agrees that the Owner has the same rights as any beneficiary of such trusts to examine the books and records of the Contractor to determine such compliance, from time to time at the Owner's sole discretion. The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of such Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in similar manner.

§ 9.6.2.1 Within seven (7) days of receipt of a payment from the Owner, the Contractor shall pay each of its Subcontractors and suppliers for work performed and materials furnished by them as reflected in the payment from the Owner, less an amount necessary to satisfy any outstanding claims, liens, or judgments and less a retained amount of not more than 5%, except that the Contractor may retain not more than 10% provided that prior to entering into a Subcontract with the Contractor, the Subcontractor is unable or unwilling to provide a performance bond and labor and material payment bond both in the full amount of the subcontract at the request of the Contractor. The Contractor shall not retain portions of the proceeds owed any Subcontractor or supplier from the Owner's payment to the Contractor for the "contract balance." Similar provisions apply to the Subcontractor and supplier paying each of its Subcontractors and suppliers. Nothing in this Section shall create in the Owner any obligation to pay, or to ensure that the Contractor pays, any Subcontractor or supplier, or any relationship in contract or otherwise, implied or expressed, between any Subcontractor or supplier and the Owner. The Contractor agrees that it shall comply with the payment requirements of Section 106-b(2) of the New York General Municipal Law, as amended, and that to the extent there is any conflict between that statutory section and the provisions of this Section 9.6.2.1, the provisions of the statute shall prevail.

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§ 9.6.3 The Construction Manager will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Owner, Construction Manager and Architect on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven (7) days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Construction Manager nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to its suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.7 Failure of Payment

If, through no fault of the Contractor, the Owner does not pay the Contractor the amount certified by the Construction Manager and Architect, subject to the Owner's right to withhold payment under the terms of the Contract Documents, within 30 days of the date established for such payment in the Contract Documents, then the Contractor may, upon seven (7) additional days' written notice and opportunity to cure to the Owner, Construction Manager and Architect, stop the Work until payment of the amount owing has been received. To the extent it is

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determined that payment to the Contractor was improperly held through no fault of the Contractor and the Contractor elected to stop its Work consistent with the procedure set forth in this Section, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up as provided for in the Contract Documents. However, if the Contractor stops its Work and it is determined that the Owner had the right to withhold payment under the terms of the Contract Documents, then the Contractor shall be responsible to the Owner for all costs and damages (including attorneys' fees) arising from such stoppage of Work and the Contractor shall not be entitled to any adjustment in the Contract Sum or the Contract Time. This Section shall not apply: (a) to the extent that the Contractor owes to the Owner any amount pursuant to the provisions of this Contract, or (b) to the extent the Owner is required to expend amounts to purchase additional insurance on behalf of the Contractor to meet the insurance requirements of this Agreement.

§ 9.8 Substantial Completion

§ 9.8.1 The date of Substantial Completion of the Project or a designated portion thereof is the date when construction is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the entire Project (or such portion thereof as Owner earlier elects to occupy or utilize) for the use for which it is intended. Minor items of completion or correction ("Punch List Work") may be performed after Substantial Completion, provided that such items can and shall be performed at such times and in such manner that such Work does not unreasonably interfere with the Owner's occupancy and use of the Project. Substantial Completion shall not be deemed to exist until (a) the Owner receives a Certificate of Occupancy for the Project (or such portion as elected by Owner) if such Certificate of Occupancy is required, and any other permits, approvals, licenses and any other documents from governmental authorities having jurisdiction therefore necessary for the beneficial occupancy of the Project and (b) the Contractor, Construction Manager, Architect and Owner have agreed upon a schedule for final completion and to provide the Owner with all as-built drawings, operating manuals, warranties and other required closeout documents. Warranties called for by the Agreement or by the Drawings and Specifications shall commence on the date of Substantial Completion of the Project or designated portion thereof, or any later date that the parties agree. This date shall be established by a Certificate of Substantial Completion signed by the Owner, Contractor, Architect and Construction Manager.

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§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall notify the Construction Manager in writing on the Contractor's letterhead and the Contractor shall prepare and attach thereto a comprehensive list, to be submitted to the Architect, identifying all non-conforming, defective and incomplete Work. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the list, the Architect, assisted by the Construction Manager, will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the requirements of the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Construction Manager or Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect, assisted by the Construction Manager, to determine Substantial Completion. If the Architect and the Construction Manager are required to perform additional substantial completion inspections because the Work fails to be substantially complete, the amount of compensation paid to the Architect and the Construction Manager by the Owner for additional services shall be deducted from the final payment to the Contractor.

§ 9.8.4 When the Architect, assisted by the Construction Manager, determines that the Work or designated portion thereof is substantially complete, the Construction Manager will prepare, and the Construction Manager and Architect shall execute, a Certificate of Substantial Completion that shall establish the date of Substantial Completion, establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and fix the time within which the Contractor shall finish all Punch List Work, which timeframe shall not exceed 30 days. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if

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any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.8.5.1 In conformance with New York General Municipal Law Section 106-b(1)(a), upon proper execution of Certificate of Substantial Completion of Work, the Contractor shall submit a requisition for payment of the remaining amount of the Contract Sum. Upon certification of payment by the Architect, the Owner will approve and promptly pay the remaining amount of the Contract Sum less two times value of any remaining items to be completed or corrected and less an amount necessary to satisfy any claims, liens or judgments against Contractor which have not been suitably discharged. Such payment shall be made under terms and conditions governing final payment except that the Owner's making of such payment shall not constitute the Owner's waiver of any objection to all or any portion of the Work performed by the Contractor or any claims the Owner may then have against the Contractor.

§ 9.8.5.2 Neither the requisition for payment stipulated in Section 9.8.5.1 nor any portion of retained percentage shall become due until the Contractor submits to the Construction Manager:

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- **.1** an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the work for which the Owner or the Owner's property might in any way be responsible, have been paid or otherwise satisfied, the forms of which will be the currently authorized AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims" and G706A "Contractor's Affidavit of Release of Liens";
- **.2** consent of all sureties, if any, to such payment, the form of which will be the currently authorized AIA Document G707A, "Consent of Surety to Reduction in or Partial Release of Retainage," but which will not be required if the amount withheld under Section 9.8.5.1 exceeds the amount of retainage;
- **.3** if required by the Owner, other data establishing payment or satisfaction of all such obligations, such as receipts, releases, and waivers of liens arising out of contract to such extent and in such form as may be designated by the Owner; and
- **.4** all closeout documents.

§ 9.8.5.3 As the Punch List Work is satisfactorily completed or corrected, the Contractor may submit a requisition for payment of these items. The Contractor shall submit with each such requisition for payment affidavits, consents of surety, and other data as described in Section 9.8.5.2 covering work for which payment is requested. Upon certification of such requisitions by the Architect and Construction Manager, the Owner will approve and promptly pay the requisition less an amount two times that which is necessary to satisfy any claims, liens or judgments against the Contractor which have not been suitably discharged.

§ 9.8.5.4 Where the Project includes heating, air conditioning, electrical, communication, data or other systems which are not put into operation at the time of occupancy, a sum shall be withheld until these systems have operated to the general satisfaction of the Architect. The Contractor shall provide complete start up and commissioning of the systems with a detailed check list as recommended by the equipment or system manufacturer. The retained amount shall approximate five percent (5%) of the cost of the systems as determined by the cost breakdown submitted. The guaranty/warranty period for such systems will not commence until after such Architect approval.

§ 9.8.5.5 The Contractor shall complete the Punch List Work for the Project no later than 30 days after Substantial Completion of the Project. The Contractor shall be fully liable to the Owner for all damages suffered by the Owner as a result of delay in achieving final completion of the Work, including without limitation, additional architectural and construction management fees related to extended services.

§ 9.8.6 If the Architect or the Construction Manager is required to inspect the Work more than two (2) times prior to certifying the Work as being substantially complete on account of the discovery of one or more items that are not sufficiently complete, the Contractor shall be liable to the Owner for the amount of any costs, additional fees or compensation due from or paid by the Owner to the Architect or the Construction Manager for the additional inspections.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the

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Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor and Construction Manager shall jointly prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect after consultation with the Construction Manager.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Construction Manager, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

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§ 9.9.4 The Contractor shall cooperate with the Owner in order to make portions of the Project available as soon as possible.

§ 9.9.4.1 The Project site and buildings, whether work of the Contractor is partially or fully completed or not, are property of the Owner who shall have certain rights and privileges in connection with use of same.

§ 9.9.4.2 Should there be, in the opinion of the Architect or Construction Manager, unwarranted delay on part of any Contractor in completion of incomplete or defective work or other Contract requirements, and the Architect so certifies, the Owner may have full or partial use and occupancy of any or all portions of buildings as required for moving in or installing furniture, fixtures, supplies, or equipment and for general cleaning and maintenance work. In such event, the Contractor whose unfinished work is done subsequent to installation of furniture, fixtures, equipment, etc., shall be responsible for the prevention of any damage to such installation. Such use or occupancy by the Owner shall in no instance constitute acceptance of any of the Work.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon completion of the Work, the Contractor shall forward to the Construction Manager a written notice that the Work is ready for final inspection and acceptance and shall also forward to the Construction Manager a final Contractor's Application for Payment. Upon receipt, the Construction Manager will evaluate the completion of Work of the Contractor and then forward the notice and Application, with the Construction Manager's recommendations, to the Architect who will promptly make such inspection. When the Architect, finds the Work acceptable under the Contract Documents and the Contract fully performed, the Construction Manager and Architect will promptly issue a final Certificate for Payment or Project Certificate for Payment stating that to the best of their knowledge, information and belief, and on the basis of their on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Construction Manager's and Architect's final Certificate for Payment or Project Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.1.1 If the Work is not accepted by the Owner after final inspection and additional time is required to complete items identified during the final inspection, the date starting the two-year correction period described in Article 12.2 shall be set by the Architect at his discretion, but not later than the date of the final Certificate for Payment.

§9.10.1.2 If the Architect and the Construction Manager are required to provide additional services, extend the duration of services to the Owner, or perform additional final inspections because the Work fails to comply with the requirements of the Contract Documents, or the Contractor did not complete the Work in accordance with the construction schedule or Project schedule, the amount of compensation paid to the Architect and the Construction Manager by the Owner for additional services shall be deducted from the final payment due to the Contractor.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect through the Construction Manager (1) all closeout documents required by the Contract Documents,

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including, without limitation, as-built drawings, attic stock, maintenance manual, operating instructions and other documents required to be delivered under the Contract in connection with the Work in the form required by the Owner, (2) confirmation that all start-up, testing, balancing and commissioning of systems, equipment and other materials has been successfully completed as required by the Contract Documents, (3) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by the Owner) have been paid or otherwise satisfied the form of which will be AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims," (4) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (5) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (6) consent of surety, if any, to final payment, the form of which will be AIA Document G707-1994, "Consent of Surety to Final Payment," (7) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner, and (8) all warranties and guarantees required by the Contract Documents, including, without limitation, a 2-year maintenance bond in the penal sum of 100% of Contract Sum including change orders, and the Contractor's letter guaranteeing workmanship for two (2) years. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

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§ 9.10.2.1 In addition to the submittals required in Section 9.10.2 above, the Contractor shall submit separate final release or waivers of lien for each Subcontractor, material supplier, or others with lien rights against the Project, and shall submit a list of such parties.

§ 9.10.2.2 Submittals required above shall be made in accordance with the closeout procedures described in Division 1 of the Specifications.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Construction Manager and Architect so confirm, the Owner shall, upon application by the Contractor and certification by the Construction Manager and Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect through the Construction Manager prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment by the Owner shall not constitute a waiver of claims, causes of action, damages or complaints by the Owner.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing in accordance with Article 15 and identified in writing by that payee as unsettled at the time of final Application for Payment. The Contractor shall be liable for and shall pay the Owner the sums stipulated as Liquidated Damages in the Agreement for each calendar day of delay after the dates established for Substantial Completion and final completion in the Contract Documents, until the Work is substantially and finally complete.

§ 9.10.6 At any time a lien is filed against the Project funds, the Owner may demand that the Contractor discharge said lien, through bonding or otherwise, and the Contractor must obtain the discharge of said lien within seven (7) days of such demand at the Contractor's sole cost and expense, and at no cost to the Owner. If any lien or other encumbrance required to be removed at the Contractor's sole cost and expense pursuant to this Section is not discharged of record as aforesaid, the Owner shall have the right to take such action as the Owner shall deem appropriate (which shall include the right to cause such lien or other encumbrance to be canceled and discharged of record), and in such event, all costs and expenses incurred by the Owner in connection therewith (including, without limitation, premiums for any bond furnished in connection therewith, and reasonable attorneys' fees,

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court costs and disbursements), shall be paid by the Contractor to the Owner on demand or, at the option of the Owner, deducted from any payment then due or thereafter becoming due from the Owner to the Contractor in accordance with the provisions of these General Conditions.

§ 9.10.7 Existing warranties shall not deprive the Owner of any cause of action, right, or remedy otherwise available for breach of any of the provisions of the Contract Documents. The periods referred to above shall not be construed as limitations on the time in which the Owner may pursue any such action, right or remedy.

§ 9.10.8 The Contractor shall achieve final completion of all Work, including, without limitation, correction of punch-list items, preparation and delivery of all manuals, presentation of training and completion of final paper submissions not later than 30 days following the date of Substantial Completion. In the event the Contractor shall fail to achieve final completion of the Work within such a period of time, in addition to liquidated damages as provided in the Agreement and Article 8 above, the Contractor and the Contractor's surety shall be liable for and shall reimburse the Owner for any and all fees paid to the Architect and Construction Manager and other expenses made necessary by the Contractor's failure. Additional fees and expenses shall be charged by the Owner against any final payment due or which may become due to the Contractor, and the Contractor shall promptly pay or refund the Owner the excess, if any, upon the Owner's written request.

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ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall, as provided in Section 10.1.1, submit the Contractor's safety program to the Construction Manager for review and coordination with the safety programs of other Contractors. The Construction Manager's responsibilities for review and coordination of safety programs shall not extend to direct control over or charge of the acts or omissions of the Contractors, Subcontractors, agents or employees of the Contractors or Subcontractors, or any other persons performing portions of the Work and not directly employed by the Construction Manager. The Contractor's safety precautions and programs shall include specific steps designed to minimize the risk of contracting or spread of COVID-19, including provision of all appropriate personal protective equipment, social distancing, avoiding stacking of trades, and other reasonable precautions.

§ 10.1.1 Prior to beginning any Work, the Contractor shall submit a copy of its corporate safety plan to the Owner and the Construction Manager. Two (2) weeks after receipt of the Notice to Proceed, the Contractor shall provide a site safety logistics plan to the Construction Manager. The site safety logistics plan should minimally include locations of the eight foot high temporary fence and gates, traffic plans for deliveries and removals, refuse container locations, crane locations, pick locations, boom radium, and lift locations, stockpiles, toilet locations, site water and power locations, and safety. This plan shall also show the location of all staging and storage areas, clearly separating construction and school areas. The logistical information represented by the construction documents shall serve as a minimal guide. The Contractor is required to submit its corporate safety policy within ten (10) days of receipt of the Notice to Proceed. Said policy must minimally meet OSHA standards and define details concerning the maintenance of a safe work environment. The Contractor shall make the participation of its Subcontractors in its safety program mandatory. A list of key personnel, with addresses and telephone numbers for emergency purposes shall be forwarded to the Construction Manager and Architect. The Owner and the Construction Manager shall establish a fire coordination procedure and shall forward same to the Contractor for its use during the performance of its Work.

§ 10.1.2 The Contractor shall provide its own COVID-19 Safety Plan to the Owner prior to the start of any work. The Contractor shall designate a person on its staff to be responsible for monitoring the wearing of PPE by each person on site working with or for the Contractor. The Contractor shall strictly follow and ensure that its subcontractors follow the Contractor's COVID-19 Safety Plan as well as all applicable Center for Disease Control guidelines and federal, state and local orders.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take necessary precautions for safety of, and shall provide reasonable protection to prevent damage, injury, infection or exposure to COVID-19, or loss to

.1 employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor;

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.3 the Owner's real and personal property and other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction;

.4 construction or operations by the Owner, Separate Contractors, or other Contractors; and

.5 the existing buildings and premises in the vicinity of or affected by the Contractor's operations.

§ 10.2.1.6 Safe access to and egress from any building under construction as part of this Contract, or any existing building in which Work is being done under this Contract, shall be maintained and remain unencumbered by the Contractor in accordance with all applicable codes, rules and regulations of authorities having jurisdiction on the Work. The Contractor and its Subcontractors shall cooperate in maintaining this condition. Roadways, paths, walks, exits, service drives and other areas shall remain unobstructed and shall be maintained in a safe and satisfactory condition, for all persons using the building and premises. Materials shall not be stored promiscuously about the site or in the building, but shall be carefully stored in areas which will not interfere with pedestrian traffic or with access to and egress from adjacent properties and use of the building. The Contractor shall provide and maintain such temporary Work as may be required for the protection of its finished Work where liable to injury or damage. The Contractor will be responsible for all of its Work, materials and equipment that may be damaged or stolen during the duration of the Contract and until the Work is accepted by the Owner. The Contractor shall make good any such damage or loss without expense to the Owner. The Contractor shall not permit unnecessary hazards to be created nor permit them to continue if they are discovered. The Contractor's storage and staging areas shall be only in locations assigned or approved by the Owner and Architect and may be required to be relocated by the Contractor as building occupancy or use changes during the course of the Work. This relocation will be done by the Contractor at no additional cost to the Owner.

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§ 10.2.2 The Contractor shall comply with, and give notices required by, applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.2.1 The Contractor acknowledges that the Labor Law of the State of New York, and regulations adopted thereunder, place upon both the Owner and the Contractor certain duties and that liability for failure to comply therewith is imposed on both the Owner and the Contractor regardless of their respective fault. The Contractor hereby agrees that, as between the Owner and the Contractor, the Contractor is solely responsible for compliance with all such laws and regulations imposed for the protection of persons performing the Contract. The Contractor shall indemnify and hold harmless the Owner of and from any and all liability for violation of such laws and regulations and shall defend any claims or actions which may be brought against the Owner as the result thereof. In the event that the Contractor shall fail or refuse to defend any such action, the Contractor shall be liable to the Owner for all costs of the Owner in defending such claim or action and all costs of the Owner, including attorney's fee, in recovering such defense costs from the Contractor.

§ 10.2.2.2 All laborers, workers, and mechanics employed in the performance of the Work of this Project shall be certified as having successfully completed a course in construction safety and health approved by the United States Department of Labor's Occupational Safety and Health Administration that is at least 10 hours in duration. The Contractor and its Subcontractors shall conduct their operations in accordance with the Safety Guides for Construction as issued by the SED, and the Contractor's safety program.

§ 10.2.2.3 All safety equipment including hard hats, weather protective gear and PPE required for the Contractor to perform its Work are to be supplied by the Contractor or its Subcontractors. Within the designated construction areas, the Contractor's employees, superintendents, or other agents, and its Subcontractors, employees, superintendents, or other agents are required to wear hard hats and other required or essential safety equipment. Each person seen without a hard hat, or otherwise failing to comply with this requirement, will be ordered to leave the Project. No prior warnings will be given by the Owner, Construction Manager or Architect. The Contractor and its Subcontractors shall be solely responsible for making up and paying for any loss of production or required progress resulting from the removal of personnel from the Project as set forth herein including any costs incurred by the Owner in connection with the work of other contractors.

§ 10.2.2.4 The Contractor and its Subcontractors shall provide blankets and auxiliary fire protection as part of its construction safety program to prevent damage to adjacent work or materials as a result of its welding or burning operations. Additionally, as part of its construction safety program, the Contractor and its Subcontractors shall provide a fire watch, with a fire extinguisher, which is acceptable to the Owner and the Construction Manager.

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§ 10.2.2.5 The Construction Manager and/or Owner reserve the right to have all operating equipment periodically inspected by an independent inspector whose finding will be binding. The Contractor, at its own expense, must make corrections within two (2) working days of receiving a written report identifying any deficiencies.

§ 10.2.2.6 All flagmen required for deliveries to the site are to be furnished by the Contractor or its Subcontractors responsible for the delivery. Any and all deliveries crossing the site or student traffic areas shall be escorted by flagmen. All flagmen shall wear orange vests.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

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§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss to property referred to in Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4, except damage or loss attributable to acts or omissions of the Owner, Construction Manager or Architect or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18, and shall not be limited by such damage or loss being insured under property insurance required by the Contract Documents.

§ 10.2.6 The Contractor shall schedule weekly safety meetings and each of its Subcontractors must be properly represented at such meetings. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. The Contractor shall notify the Construction Manager in writing its "OSHA Competent Person Regarding Safety." Said person must be an individual capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Construction Manager and Architect. The Contractor shall take all necessary steps to prevent its employees from disturbing and/or damaging the facility and shall be responsible for preventing the escape of fires set in connection with the construction. The Contractor shall notify its employees and subcontractors of the location of the nearest fire alarm box at all locations where the work is in progress. On a weekly basis, the Contractor shall submit to the Construction Manager and Architect minutes of its safety meetings, which minutes shall include a list of the individuals present at such meetings.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition. The Contractor shall not load any part of the Work with materials, equipment, shores, bracing, or other items which in any way could cause damage to the Work or to other Work or could endanger persons in or about the Work.

§ 10.2.8 If, during the construction, public or private property is damaged or destroyed as a consequence of its Work, the Contractor shall, at its own expense, restore such property to a condition equal to that existing before such damage or injury was done, by repairing, rebuilding or replacing it, or otherwise making good such damage or destruction in an acceptable manner.

§ 10.2.9 The Contractor shall be responsible for all breakage of glass, which has been furnished and installed as part of Contract and existing glass that is broken due to operations under the Contract for Work. No matter by whom or what cause glass was broken, the Contractor shall replace all broken glass before completion and acceptance of the Contractor's Work. The Contractor may claim damages, if applicable.

§ 10.2.10 In addition to all requirements set forth herein, the Contractor and its Subcontractors shall fully comply

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with the provisions of the federal Occupational Safety and Health Act of 1970, as amended, and with any rules and regulations pursuant to that Act. This requirement shall apply continuously and not be limited to normal working hours.

§ 10.2.11 The Contractor shall also be responsible, at the Contractor's sole cost and expense, for all measures necessary to protect any property adjacent to the Project and improvements therein. Any damage to such property or improvements shall be promptly repaired by the Contractor at its sole expense.

§ 10.2.12 The Contractor shall immediately contact the Construction Manager and, within 24 hours, report, in writing, to the Owner, Architect and Construction Manager, all accidents arising out of or in connection with the Work which cause death, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately by telephone or messenger to the Owner, Construction Manager, and Architect.

§ 10.2.13 The Contractor shall be solely responsible for any conditions that develop during construction and in the event any structure is dislocated, over strained, or damaged so as to affect is usefulness, the Contractor shall be solely responsible. The Contractor shall take whatever steps necessary to strengthen, relocate or rebuild the structure to meet requirements at the sole expense of the Contractor.

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§ 10.2.14 The Contractor is responsible for restoration and repair of utilities, private property, buildings, pavement, walkways, roads, etc. damaged by its activities under this Agreement to the satisfaction of the Owner, Construction Manager and Architect.

§ 10.2.15 From the commencement to the final completion of the Work, the Contractor shall keep the Work and the Owner's building(s) free from accumulation of water no matter the source or cause of water infiltration.

§ 10.2.16 During construction, the Contractor shall be responsible for maintaining a watertight structure. This responsibility shall include additions/alterations of existing buildings. The Contractor shall be responsible for temporary roofing, tarps and other protection at roofs, cavity walls, etc. Should the Contractor fail to provide adequate protection causing flooding, damage or other disturbance to the existing building(s), the Contractor shall be responsible for all costs associated with clean up, remediation and repairs. Inasmuch as flooding and water damage have safety implications to the general public, clean up, remediation and repairs may be made by the Owner without prior notice to the Contractor. Administration costs incurred by the Owner, Construction Manager and Architect will also be back-charged to the Contractor. The Contractor, by entering into this Contract, agrees to be liable for these costs.

§ 10.2.17 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents and all applicable laws, rules and regulations regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to, asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner, Construction Manager and Architect in writing. The Owner shall arrange for the material to be tested and if the test reveals that the material is a hazardous material or substance which has not been rendered harmless, the Owner shall pay for the test; otherwise, the Contractor shall bear the cost of the test and the Contract Sum shall be reduced by the amount of that cost. The Contractor shall comply with the reasonable instructions of the Owner after the test is conducted. This Section shall not apply in the case of asbestos which is to be removed and disposed of as part of the Work of the Contract.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify a presence or absence of the material or substance reported by the Contractor and, in the event such

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material or substance is found to be present, to cause it to be rendered harmless. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the fullest extent permitted by law, but only to the extent of available insurance proceeds, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Construction Manager, Architect, their consultants, and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that the person seeking indemnification: (1) did not bring such material onto the Project site; (2) timely provided notice of the condition and stopped Work in the affected area as required by Section 10.3.1; and (3) has a claim, damage, loss or expense that is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself). The Owner shall have no indemnity obligation to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity or the fault or negligence of a third party for whom the Owner is not responsible.

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§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence or fault on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance (that was not brought to the site by the Contractor or those for whom the Contractor is responsible) solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.3.7 The Contractor shall notify the Owner of any storage, use, or discovery of hazardous material on the Project site which the Contractor knows or reasonably should know could cause bodily injury or death and of any injury or death attributable to any such hazardous material.

§ 10.3.8 The Contractor shall take all reasonable precautions and measures to prevent any contamination by or spread or disturbance of hazardous or potentially hazardous substances or materials stored, used, or discovered on the Project site.

§ 10.3.9 For the avoidance of any doubt, COVID-19 shall not be considered a Hazardous Material for purposes of this Article 10.3.

§ 10.4 Emergencies

§ 10.4.1 The Contractor shall provide at the site, such equipment and medical facilities as are necessary to supply first-aid service to anyone at the Work.

§ 10.4.2 The Contractor must promptly report in writing to the Construction Manager all emergencies whatsoever arising out of, or in connection with the performance of the Work, whether on, or adjacent to the site, which caused death, personal injury or property damages, giving full details and statements of witnesses. In addition, if death, injury, or damages are caused, the emergency shall be reported immediately to the Construction Manager, Owner, and Architect.

§ 10.4.3 In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

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§ 10.4.4 All fire and emergency access, including roads, rights-of-way, corridors, doors, and stairs, and all existing fire and smoke detection systems shall be maintained at all times in accordance with fire safety laws. If the Work requires the temporary obstruction of any fire and emergency access or existing fire and smoke detection systems, the Construction Manager shall be notified at least 72 hours in advance.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies licensed and admitted to conduct business in State of New York, having an A.M. Best rating of A- or better, and one to which the Owner has no reasonable objection such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

.1 Claims under workers' compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed, including private entities performing Work at the site and exempt from the coverage on account of number of employees or occupation, which entities shall maintain voluntary compensation coverage at the same limits specified for mandatory coverage for the duration of the Project. As required by the New York State Workers' Compensation Law, all out of state contractors working in New York must provide a Workers' Compensation Insurance Policy that specifically lists New York in Item 3A of the Policy Information page;

.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

.4 Claims for damages insured by usual personal injury liability coverage;

.5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;

.6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;

.7 Claims for bodily injury or property damage arising out of completed operations;

.8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18;

.9 Where the Contract or Subcontract involves asbestos, the insurance required by Section 11.1 shall specifically include the words asbestos abatement work and shall specify any limitations on completed operation time period. If there is a limitation it will be at the Owner's discretion to accept or reject that limitation;

.10 Insurance must remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing or replacing defective Work in accordance with Section 12.2.2.2;

.11 Liability insurance shall include all major divisions of coverage and be on a comprehensive basis. The required coverage shall be written on an occurrence basis and shall include the following:

a. Premises Operations (including X, C and U coverage as applicable).
b. Independent Contractor's Protective.
c. Products and Completed Operations.
d. Contractual, including specified provision for Contractor's obligation under Paragraph 3.18 of the General Conditions.
e. Owned, non-owned, borrowed and hired motor vehicles.
f. Broad Form Property Damage including Completed Operations.
g. Pollution Legal Liability Insurance.
h. Personal injury liability with Employment Exclusion deleted.

.12 The insurance policies required to be purchased and maintained by the Contractor under this Agreement shall be: (i) written on an occurrence basis, and (ii) shall be primary on a per project basis for the defense and indemnification of any action or claim asserted against the Owner and its Board of Education, officers, employees and volunteers, Construction Manager, Architect, and the Contractor for Work performed under the Agreement regardless of any other collectible insurance or any language in the insurance policies that may be to the contrary. The policies of the Owner, Construction Manager and Architect and their consultants shall be excess and noncontributory. A New York licensed and admitted insurer is required.

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.13 Subcontractors are subject to the same terms and conditions as stated above and must submit same to the Owner for approval prior to the start of any work.

§ 11.1.2 The insurance required by this Article 11 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of three years after final completion of the Work. All coverages are to be written on an occurrence basis unless approved by the Owner. The Contractor will require all of its Subcontractors to comply with the insurance requirements of this Article 11.

§ 11.1.3 ACORD Form 25S shall be an acceptable form for the Certificates of Insurance when accompanied by AIA Form G715 and all applicable endorsements for the required coverages. The certificate of insurance must describe all services provided by the Contractor (e.g., roofing, carpentry, plumbing) that are covered by the liability policies. The Contractor shall also provide the Owner with copies of any endorsements subsequently issued amending coverage or limits. At the Owner's request, the Contractor shall provide a copy of the declaration page of the liability and umbrella/excess policies with a list of endorsements and forms. If requested, the contractor will provide a copy of the policy endorsements and forms. A fully completed New York Construction Certificate of Liability Insurance Addendum (ACORD 855 2014/15) must be included with the certificates of insurance. For any "Yes" answers on Items G through L on this Form– additional details must be provided in writing. Policy exclusions may not be accepted. No construction shall be commenced until the Owner has approved the Contractor's certificates of insurance and required endorsements. These certificates and the insurance policies required by Section 11.1 shall contain a provision that the coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days prior written notice has been given to the Owner and the Contractor. If any of the foregoing insurance coverages are required to remain in force after final payment, an additional certificate and a copy of the insurance policy evidencing continuation of such coverage shall be submitted with the final Application for Payment as required by Section 9.10.2. Review and acknowledgement of the certificates of insurance and endorsements by the Owner or Architect shall not relieve or decrease the liability of the Contractor hereunder.

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§ 11.1.3.1 The Contractor's failure to procure or maintain insurance required under this Contract, or provide the required proof of such insurance, shall constitute a material breach of the Contract for which the Owner may, in its sole discretion, stop the Work, withhold payment, or suspend or terminate the Contract. In response to such failure the Owner also may, at its sole discretion, procure or renew such insurance necessary to protect the Owner's interests, pay any premiums in connection therewith and recover (or deduct) all amounts so paid, as well as all other costs and fees incurred as a result of such breach, from the Contractor. It shall not be the basis for an extension of the Contract Time if the operations, services or Work is stopped or delayed due to the Contractor's failure to provide the required insurances or proof of same. The foregoing rights and remedies of the Owner are in addition to the Owner's other rights and remedies. The Contractor shall fully cooperate at all times with any effort by the Owner or Construction Manager to audit compliance with the insurance requirements of Article 11. The Contractor understands and agrees that (a) the Owner's receipt of proper ACORD certificates of insurance and endorsements from the Contractor shall be a condition precedent to the Owner's obligation to make any progress payment under the Agreement, and (b) it shall not be the basis for an extension of the Contract Time if the operations, services or Work is stopped or delayed due to the Contractor's failure to provide proper ACORD certificates of insurance and endorsements.

§ 11.1.4 The Contractor shall cause all liability insurance policies coverage required by the Contract Documents (excluding Workers' Compensation) to include (1) the Owner and its Board of Education, officers, employees and volunteers, Construction Manager, Architect, and their consultants as additional insureds on a primary and non-contributory for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner and its Board of Education, officers, employees and volunteers as additional insureds on a primary and non-contributory for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations. If the terms of policies expire, or the lives of the insurance companies terminate, before the Contract is completed or during the period of completed operations coverage, and the Contractor fails to maintain continuance of such insurance, the Owner is entitled to provide protection for itself, to pay premiums, and to charge the cost to the Contractor.

§ 11.1.4.1 Additional insured status for Commercial General Liability coverage shall be provided by standard or other endorsements that extend coverage to the Owner for on-going operations (CG 20 38 or equivalent) and

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products and completed operations (CG 20 37 or equivalent). The decision to accept an endorsement rest solely with the Owner. A completed copy of the endorsements must be attached to the Certificate of Insurance to include Commercial General Liability, Auto Liability and Umbrella/Excess coverages.

§ 11.1.5 It is expressly understood and agreed that:

.1 The amount of insurance provided in the insurance coverages required by Article 11 and any other provision of the Contract Documents shall not be construed to be a limitation of the liability on the part of the Contractor or any of its Subcontractors.

.2 Any type of insurance or any increase in limits of liability not described above which the Contractor requires for its own protection or on account of statute or otherwise shall be its own responsibility and at its own expense and shall not be charged back to the Project.

.3 The carrying of insurance described shall in no way be interpreted as relieving the Contractor or any Subcontractor of any responsibility or liability under the Contract.

.4 In the event of a failure of Contractor to furnish and maintain said insurance and to furnish satisfactory evidence thereof, the Owner shall have the right (but not the obligation) to take out and maintain the same for all parties on behalf of the Contractor who agrees to furnish all necessary information thereof and to pay the cost thereof to the Owner immediately upon presentation of an invoice.

.5 Any work performed without having the insurance coverage is at the Contractor's own risk.

.6 Any applicable deductibles and self-insured retentions on the policies required by this Article 11 are the sole responsibility of the Contractor. The Contractor agrees to indemnify the Owner for applicable deductibles and self-insured retentions.

.7 There will be no coverage restrictions and/or exclusions involving New York State Labor Law statutes or gravity related injuries.

.8. No policies containing escape clauses or exclusions contrary to the Owner's interests will be accepted.

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§ 11.1.6 Schedule of Insurance

The Contractor and its Subcontractors, at their own expense, shall procure and maintain the following insurance coverages with limits of liability not less than the limits specified, or greater if required by law.

§ 11.1.6.1 Workers' Compensation and Employers' Liability

Workers' compensation and employers' liability insurance coverage complying with the laws of the State of New York and elsewhere as may be required and shall include a minimum of:

Workers' Compensation	Statutory
Bodily Injury by Accident:	$1,000,000 Each Accident
Bodily Injury by Disease:	$1,000,000 Each Employee
Bodily Injury by Disease:	$1,000,000 Policy Limit

Statutory Workers' Compensation (C-105.2 or U-26.3); and NYS Disability Insurance (DB-120.1) for all employees. Proof of coverage must be on the approved specific form, as required by the New York State Workers' Compensation Board. ACORD certificates are not acceptable. A person seeking an exemption must file a CE-200 Form with the state. The form can be completed and submitted directly to the WC Board online.

The workers' compensation and employers' liability policies shall be endorsed to waive the right of subrogation against the Owner and its Board of Education, officers, employees and volunteers.

§ 11.1.6.2 Commercial General Liability

Commercial General Liability written on ISO occurrence form providing coverage for Premises and Operations, Products-Completed Operations, Independent Contractors, Personal and Advertising Injury, Blanket Contractual Liability, and Broad Form Property Damage (including coverage for Explosion, Collapse, and Underground Hazards). Minimum limits are as follows:

$1,000,000 per Occurrence/$2,000,000 Aggregate
$2,000,000 Products and Completed Operations
$1,000,000 Personal and Advertising Injury
$100,000 Fire Damage

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$10,000 Medical Expense
The general aggregate shall apply on a per-project basis.

Products and Completed Operations Coverage must be maintained for a period of at least three (3) years after final payment and must provide that the Owner is an additional insured on a primary basis for the same period. These limits must apply on a per project basis. Coverage must be written on CG 00 01 form or its equivalent. The Commercial General Liability policy shall be endorsed to waive the right of subrogation against the Owner and its Board of Education, officers, employees and volunteers.

§ 11.1.6.3 Automobile Liability
Business Automobile Liability, including liability arising out of any owned, leased, borrowed, non-owned or hired automobile with per accident limits of liability of not less than $2,000,000. The Contractor shall cause the automobile liability coverage required herein to include the Owner and its Board of Education, officer, employees and volunteers, Construction Manager, Architect, and their consultants as additional insureds on a primary and non-contributory basis. The automobile liability policy shall be endorsed to waive the right of subrogation against the Owner and its Board of Education, officers, employees and volunteers.

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§ 11.1.6.4 Excess Liability and/or Umbrella Liability. Minimum limits are:

.1 $5,000,000 per occurrence and $5,000,000 aggregate for general construction and no work at elevation (1 story or 10 feet) and project values less than or equal to $1,000,000;

.2 $10,000,000 each occurrence and aggregate for high-risk construction, work at elevation (>1 story or 10 feet) and project values greater than $1,000,000.

Umbrella/Excess coverage shall be on a follow-form basis or provide broader coverage over the Commercial General Liability and Auto Liability coverages. The Umbrella/Excess liability policy shall be endorsed to waive the right of subrogation against the Owner and its Board of Education, employees and volunteers.

§ 11.1.6.5 Riggers Liability Insurance
If Work involves rigging, hoisting, lowering, raising or moving of property or equipment not belonging to the Contractor, Riggers Liability Insurance is required to insure for the full value of the property or equipment against physical loss/damage.

§ 11.1.6.6 Owners Contractors Protective Liability Insurance
The Contractor shall procure and maintain at Contractor's own expense until final completion of the Work covered by the Contract, and any extension thereof, Owners Contractors Protective (OCP) Liability Coverage issued in the name of the Owner and covering the liability for damages imposed by law upon the Owner and/or Construction Manager with respect to all operations under the agreement by the Contractor or its Subcontractors, including omissions and supervisory acts of the Owner and Construction Manager. Such policy shall be delivered to the Owner and Construction Manager no later than fifteen (15) days of awarding the Contract. The OCP policy must be with a NYS licensed and admitted carrier. Unless otherwise specifically required by special specifications, each policy shall be issued with limits not less than the following:

- For projects less than or equal to $1,000,000 and/or work on 1 story (10 feet) only; $1,000,000 per occurrence, $2,000,000 aggregate with the Owner as the Named Insured.

- For projects greater than $1,000,000 and/or work over 1 story (10 feet); $2,000,000 per occurrence, $4,000,000 aggregate with the Owner as the Named Insured.

The Owner will be the Named Insured on OCP Policies. There will be no Additional Insureds on any OCP Policies.

§ 11.1.6.7 Asbestos/Lead Abatement/Pollution Liability Insurance
$2,000,000 per occurrence/$2,000,000 aggregate, including products and completed operations. Such insurance shall include coverage for the Contractor's operations including, but not limited to, removal, replacement, enclosure, encapsulation and/or disposal of asbestos, or any other hazardous material, along with any related pollution events, including coverage for third-party liability claims for bodily injury, property damage and clean-up costs. The policy shall also include coverage for non-owned disposal site liability, Mold Remediation and Related Expenses. If a retroactive date is used, it shall pre-date the inception of the Contract.

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If the Contractor is using motor vehicles for transporting hazardous materials, the Contractor shall maintain pollution liability broadened coverage (ISO Endorsement CA 9948 or CA 01 12), as well as proof of MCS 90. Coverage shall fulfill all requirements of these specifications and shall extend for a period of three (3) years following acceptance by the Owner of the Certificate of Completion.

The Contractor shall cause the pollution liability coverage required herein to include the Owner and its Board of Education, officers, employees and volunteers, Construction Manager, Architect, and their consultants as additional insureds on a primary and non-contributory basis. The pollution legal liability policy shall be endorsed to waive the right of subrogation against the Owner and its Board of Education, officers, employees and volunteers.

§ 11.1.6.7 Testing Company Errors and Omission Insurance
$1,000,000 per occurrence/$2,000,000 aggregate for the testing and other professional acts of the Contractor performed under the Contract with the Owner.

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§ 11.2 Owner's Liability Insurance
The Owner shall be responsible for maintaining its usual liability insurance.

§ 11.3 Property Insurance
§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for the Architect's, Contractor's, and Construction Manager's services and expenses required as a result of such insured loss. The form of policy for this coverage shall be Completed Value. Notwithstanding the definition of the "Work" in this Contract or in this Section 11.3.1.1, the Contractor assumes all responsibility for the safety and keeping of all tools and equipment and any materials or products used to complete or perform the Work, and which do not form a permanent part of the Work. The Contractor waives all rights against the Owner and Architect, their consultants, sub-consultants, employees and agents for any loss or damages to any such tools, equipment or any material or products used to complete or perform the Work, and which do not form a part of the Work. The Contractor shall require similar waivers in favor of the above-named parties from all Subcontractors and Sub-subcontractors, agents and employees of any of them.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 Losses up to the deductible amount shall be the responsibility of the Contractor unless caused solely by the Owner.

§ 11.3.1.4 The Contractor shall provide insurance coverage for portions of the Work stored off the site, in transit, and stored on the site but not incorporated into the Work on a full replacement cost basis. The Contractor is responsible for all deductible amounts.

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§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.1.6 The insurance required by Paragraph 11.3 is not intended to cover machinery, tools or equipment owned or rented by the Contractor which are utilized in the performance of the Work but not incorporated into the permanent improvements. The Contractor shall, at the Contractor's own expense, provide insurance coverage for owned or rented machinery, tools, or equipment which shall be subject to the provisions of Subparagraph 11.3.7.

§ 11.3.1.7 The Owner shall not be responsible to or for the Contractor or Subcontractors against any loss by fire, lightning, extended coverage, all risk, theft or vandalism and malicious mischief, of any tools, equipment, vehicles, shanties, tool houses, trailers, or other temporary or permanent structures wherever located and owned by the Contractor, Subcontractors, their employees or agents.

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§ 11.3.2 Boiler and Machinery Insurance. The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Construction Manager, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 Loss of Use Insurance. The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, adjoining or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project.

§ 11.3.7 Waivers of Subrogation. The Owner and Contractor waive all rights against each other and any of their Consultants, Architects, Construction Manager, subcontractors, sub-subcontractors, agents and employees each of the other and Owner's separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Article 11 or other insurance applicable to the Work, except such rights as the Owner and Contractor may have to the proceeds of such insurance held by the Owner as fiduciary. The Contractor shall require each of the subcontractors, sub- subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged. To the extent that a waiver of subrogation is unavailable to the Owner and the absence of such right of subrogation, or the Owner's giving such a waiver, would constitute a breach of its insurance policy; then as to the Owner this Section 11.3.7 shall be of no force or effect and no such waiver of subrogation shall be required of Owner.

§ 11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any

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applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 The Owner, as fiduciary, shall have the power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five (5) days after occurrence of loss to the Owner's exercise of this power.

§ 11.3.10 All insurance policies maintained by the Contractor shall include a waiver of any and all rights of subrogation of the Contractor or its Insurers against the Owner and Architect, along with all other Additional Insureds/Indemnified Parties and their agents, officers, directors and employees for recovery of damages. The Contractor further waives its right of subrogation against the Owner or any Additional Insured or Indemnified Party for any damage or loss to the Contractor's scope of work, tools, equipment, materials or any other loss within the scope of any insurance maintained by the Owner.

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§ 11.4 Performance Bond and Payment Bond

§ 11.4.1 The Contractor shall furnish performance and labor and material payment bonds, each in an amount equal to one hundred percent (100%) of the Contract Sum, meeting all statutory requirements of the State of New York, in form and substance satisfactory to the Owner in its sole discretion and, without limitation, complying with the following specific requirements:

- **.1** The prescribed form of the performance and payment bonds shall conform to AIA A312-2010, and other shall be satisfactory to the Owner in the Owner's sole judgment;
- **.2** The cost of the required bonds shall be included in the Contract Sum;
- **.3** Bonds shall be executed by a responsible surety licensed in New York State, listed in the latest issue of the U.S. Treasury Circular 570 and having an A.M. Best's rating of no less than A-/IX and shall remain in effect for a period not less than two years following the date of Substantial Completion or the time required to resolve any items of incomplete Work and the payment of any disputed amounts, whichever time period is longer;
- **.4** The Contractor shall require the attorney in fact who executes the required bond on behalf of the surety to affix thereof a certified and current copy of his power of attorney indicating the monetary limit of such power. The signatures of the Contractor and Surety shall be acknowledged by a notary public; and
- **.5** Every bond under this Section 11.4.1 must display the surety bond number.

§ 11.4.2 A rider including the following provisions shall be attached to each bond:

1. This bond includes performance by the Contractor of any correction and warranty obligations in the Contract Documents, including such performance after the dates of Substantial Completion and final completion.

2. Surety hereby agrees that it consents to and waives notice of any addition, alteration, omission, change, or other modification of the Contract Documents. Such addition, alteration, change, extension of time, or other modification of the Contract Documents, or a forbearance on the part of either the owner or the Contractor to the other, shall not release the Surety of its obligations hereunder and notice to the Surety of such matters is hereby waived.

3. Surety further agrees that in event of any default by the Owner in the performance of the Owner's obligations to the Contractor under the Contract, the Contractor or Surety shall cause written notice of such default (specifying said default in detail) to be given to the Owner, and the Owner shall have thirty (30) days from time after receipt of such notice within which to cure such default, or such additional reasonable period of time as may be required if the nature of such default is such that it cannot be cured within thirty (30) days. Such Notice of Default shall be sent by certified or registered U.S. Mail, return receipt requested, first class postage prepaid, to Lender and the Owner.

§ 11.4.3 All bonds shall be maintained in full force during the duration of the Project and for a period of two (2) years after the date of the Contractor's acceptance of final payment as guarantee that the Contractor will make good

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any faults or defects in the work arising from improper or defective workmanship or materials which may appear during the comeback warranty period.

§ 11.4.4 The Contactor shall deliver the required bonds to the Owner prior to beginning construction activity at the Project site, but no later than seven (7) days after execution of the Contract. Said bonds shall be issued on form AIA Document A312.

§ 11.4.5 The Owner may, in the Owner's sole discretion and without prior notice to the Contractor, inform surety of Contractor's Work and obtain consents as necessary to protect the Owner's rights, interest, privileges and benefits under and pursuant to any bond issued in connection with the Contractor's Work.

§ 11.4.6 If the surety on any Bond furnished by the Contractor is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of this Article, the Contractor shall within ten (10) days thereafter substitute another Performance and Payment Bond and surety, both of which must be acceptable to the Owner.

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§ 11.4.7 The Contractor shall keep the surety informed of the progress of the Work, and, where necessary, obtain the surety's consent to, or waiver of: (1) notice of changes in the Work; (2) request for reduction or release of retention; (3) request for final payment; and (4) any other material required by the surety. The Owner shall be notified by the Contractor, in writing, of all communications with the surety. The Owner may, in the Owner's sole discretion, inform the surety of the progress of the Work and obtain consents as necessary to protect the Owner's rights, interest, privileges and benefits under any pursuant to any bond issued in connection with the Work.

§ 11.4.8 Notwithstanding any other provisions in any performance or payment bond, it shall not be a condition precedent to termination of a Contract or Contractor that notice be sent to or meeting be arranged or held with the Contractor (principal) and surety, prior to such termination. Any such requirement(s) shall be void and unenforceable and the Owner shall have the right to reject any such bond(s) or ignore such condition. The exclusive method of termination of a Contract or the Contractor is contained in the Contract Documents, and the Contractor and surety expressly agree to be bound thereby.

§ 11.4.9 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.4.10 The Contractor shall provide for the continuation of the performance bond as a maintenance bond for two (2) full years after the date of final payment request at the full final Contract Sum.

§ 11.5 Neither the procurement nor the maintenance of any type of insurance by the Owner or the Contractor shall in any way be construed or be deemed to limit, discharge, waive or release the Contractor from any of the obligations and risks imposed upon him by the Contract or to be a limitation on the nature or extent of such obligations or risks.

§ 11.6 Nothing in the Contract shall create or give to third parties any claim or right of action against the Contractor, Architect, Construction Manager or Owner beyond such as may legally exist irrespective of the Contract.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Construction Manager's or Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by either, be uncovered for their examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered which the Construction Manager or Architect has not specifically requested to observe prior to its being covered, the Construction Manager or Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or one of the other Contractors in which event the Owner shall be responsible for payment of such costs.

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§ 12.2 Correction of Work

§ 12.2.1 Before or After Substantial Completion

The Owner, through its Architect or Construction Manager, shall have the authority to reject Work performed by the Contractor that does not conform to the requirements of the Drawings, Specifications, or both. The Contractor shall promptly correct Work rejected by the Construction Manager or Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within two (2) years after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Section 9.8.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The obligation set forth hereunder shall survive acceptance by the Owner of the Work or termination of the Contract. The Owner shall give such notice promptly after discovery of the condition. The Contractor's Performance Bond shall remain in full force and effect through this two-year comeback correction period.

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§ 12.2.2.2 The two-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 Upon completion of any Work under or pursuant to this Section 12.2, the two-year period for correction of Work in connection with the Work requiring correction shall be renewed and recommence.

§ 12.2.2.4 The obligations shall cover any repair and replacement to any part of the Work or other property caused by the defective Work.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.3.1 If the Contractor fails to commence to correct, repair and make good any defects in its Work within a reasonable time, not to exceed ten (10) days from the date the Contractor received written notice from the Owner per Section 12.2.2.1, the Owner may correct it in accordance with Section 2.5 and the Contractor shall, upon demand, pay to the Owner all amounts which it expends for such corrective work.

§ 12.2.3.2 In emergencies occurring during the two-year correction period, the Owner may correct any defect immediately and charge the cost to the Contractor. The Owner shall at once notify the Contractor, who may take over the Work and make any corrections remaining after its forces arrive at the Work. Repair work not started within ten (10) days following notice to the Contractor of any defect may be considered an emergency.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner, other Contractors or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents. The Contractor shall also replace or repair to satisfaction of Owner any and all damage done to the building or its contents in consequence of work performed in fulfilling any applicable warranty. This clause is general in nature and will not operate to waive stipulations of other clauses that specify warranty periods in excess of two (2) years.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the two-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

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§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as determined by the Owner, with the advice of the Construction Manager and Architect. Such adjustment shall be effected whether or not final payment has been made. For this Section to apply, the Owner must accept non-conforming Work in writing specifying the non-conforming Work being accepted. Notwithstanding any acceptance by the Owner, if the Owner discovers non-conforming Work that the Owner has not expressly accepted in writing, the Owner may demand that the Contractor correct such Work as per the provisions of Article 12 hereof.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the State of New York, and the parties expressly agree that any claim, dispute, or other controversy of any nature arising out of the Contract or performance of the Work shall be commenced and maintained in New York State Supreme Court, Westchester County.

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§ 13.1.2 The Contractor shall at all times observe and comply with all federal, state and local laws and all laws, ordinances and regulations of the Owner, in any manner affecting the Work and all such orders decreed as exist at present and those which may be enacted later, by bodies or tribunals having jurisdiction or authority over the Work, and the Contractor shall defend, indemnify and save harmless the Owner and its Board of Education, officers, agents, or servants against any claim or liability arising from, or based on, a violation of any such law, ordinances, regulation, order or decree, whether by himself or by his employee or agents. Historical lack of enforcement of any law, local or otherwise, shall not constitute a waiver of Contractor's responsibility for compliance with such law in a manner consistent with the Agreement unless and until the Contractor has received written consent for the waiver of such compliance from the Owner and the agency responsible for the enforcement of such law.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 Neither the acceptance of all or any part of the work covered by the Contract; nor any payment therefore; nor any order or application for payment issued under the Contract or otherwise issued by the Owner, Architect, Construction Manager, or any board member, officer, agent or employee of the Owner; nor any permission or direction to continue with the performance of the Contract before or after its specified completion date; nor any performance by the Owner of any of the Contractor's duties or obligations; nor any aid lent to the Contractor by the Owner in its performance of such duties or obligations; nor any delay or omission by the Owner to exercise any right or remedy accruing to it under the terms of the Contract or existing at law or in equity or by statute or otherwise; nor any other thing done or omitted to be done by the Owner, its board members, officers, agents or employees; shall be deemed to be a release to the Contractor or its sureties from any obligations, liabilities or undertakings in connection with the Contract or the performance bond or a waiver of any provision of the Contract or of any rights or remedies to which the Owner may be entitled because of any breach thereof, excepting only a written instrument expressly providing for such release or waiver. No cancellation, rescission or annulment hereof, in whole or as to any part of the Contract, because of any breach hereof, shall be deemed a waiver of any money damages to which the Owner may be entitled because of such breach. No waiver by the Owner of any breach of the Contract shall be deemed to be a waiver of any other or any subsequent breach.

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§ 13.3.3 The rights stated in these General Conditions and the Contract Documents are cumulative and not in limitation of any rights of the Owner at law or in equity.

§ 13.3.4 The Owner shall not be responsible for damages or for loss of anticipated profits on Work not performed on account of any termination of the Contractor by the Owner or by virtue of the Owner's exercise of its right to take over the Contractor's Work.

§ 13.3.5 The Owner shall not be liable to the Contractor for punitive damages on account of its termination of the Contractor or any other alleged breach of the Agreement and the Contractor hereby expressly waives its right to claim such damages against the Owner.

§ 13.3.6 The Contractor hereby expressly waives any rights it may have in law or in equity to lost bonding capacity as a result of any of the actions of the Owner, the Architect or the Construction Manager taken in connection with the Contractor's Work on the Project.

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§ 13.3.7 The Contractor agrees that it waives the defense of privity of contract as between itself and each other Contractor. In the event that an act or omission by another prime Contractor or its Subcontractors of any tier causes impact, damage or loss in any form to the Contractor, then the other prime Contractor responsible in whole or in part for such impact, damage or loss agrees it is directly responsible and liable to the Contractor. The Contractor acknowledges and agrees that this waiver of the defense or privity of contract permits and requires it to commence an action or suit directly against the responsible prime Contractor. The Owner, Architect and the Construction Manager shall not be parties to such suit. The Contractor waives and relinquishes any right and claim as against the Owner, to the extent such claim is caused, or contributed to, by a prime Contractor or its Subcontractors of any tier.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Tests, inspections and approvals of portions of the Contractor's Work required by the Drawings or Specifications shall be made at an appropriate time. Unless otherwise provided, the Contractor shall arrange for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Construction Manager and Architect timely notice of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.4.2 If the Construction Manager, Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.4.1, the Construction Manager or Architect shall, upon written authorization from the Owner, instruct the Contractor to arrange for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Construction Manager and Architect of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If such procedures for testing, inspection or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Construction Manager's and Architect's services and expenses shall be at the Contractor's expense, including the cost of retesting for verification of compliance if necessary until the Architect certifies that the Work in question does comply with the requirements of the Contract Documents, and none of such costs shall be included in computing the Contract Sum.

§ 13.4.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Construction Manager for transmittal to the Architect.

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§ 13.4.5 If the Construction Manager or Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Construction Manager or Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.4.7 Any material to be furnished shall be subject to inspections and tests in the shop and field by the Architect. Shop inspection shall not relieve the Contractor of the responsibility to furnish satisfactory materials and the right is reserved to reject any material at any time before final acceptance of the Work, when in the opinion of the Architect the materials and/or workmanship do not conform to the Specification requirements.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the legal rate as required in General Municipal Law Section 106-b.

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§ 13.6 Time Limits on Claims

§ 13.6.1 No action or proceeding shall lie or be maintained by the Contractor, nor anyone claiming under or through the Contractor, against the Owner upon any claim arising out of or based on the Agreement or the Contract Documents or by reason of any act or omission or requirements relating to the giving of notices and information, unless such action or proceeding shall be commenced within one (1) year after submission to the Owner of the final Application for Payment. As to a claim based upon money required to be retained for any period after the date of the final Application for Payment, such action must be commenced within six (6) months after such money becomes due and payable under the terms of the Contract. Notwithstanding, if the Contract is terminated by the Owner, any action or proceeding by the Contractor must be commenced within six (6) months after the date of such termination. The Contractor's acceptance of final payment shall constitute a release of all claims against the Owner. This provision shall not relieve the Contractor of the obligation to comply with the provisions of the law relating to notices of claim.

§ 13.6.2 Acts or failures to act occurring during the construction of the Project or following the issuance of the final certificate for payment, which give rise to a cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any warranty provided under Section 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor under Section 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor, whichever occurs last.

§ 13.7 No Oral Waiver or Constructive Changes

The provisions of the Contract Documents shall not be changed, amended, waived, or otherwise modified in any respect except by a writing signed by the Owner. No person is authorized on behalf of the Owner to orally change, amend, waive, or otherwise modify the terms of the Contract Documents or any of the Contractor's duties or obligations under or arising out of the Contract Documents. Any change, waiver, approval, or consent granted to the Contractor shall be limited to the specific matters stated in the writing signed by the Owner, and shall not relieve the Contractor of any other of the duties and obligations under the Contract Documents. No "constructive" changes shall be allowed.

§ 13.8 Notices Regarding Liens

The Contractor shall provide to the Owner copies of all notices of any type regarding liens received from Subcontractors, Sub-subcontractors, or suppliers to the Contractor.

§ 13.9 Wages Rates

The Contractor shall, and cause its Subcontractors to, comply with prevailing wage rate determinations as issued by the State of New York Department of Labor for the location and duration of this Project. Current wage rates for this Project are included in the Project Manual.

§ 13.10 General Provisions

Any specific requirement in this Contract that the responsibilities or obligations of the Contractor also apply to a Subcontractor is added for emphasis and is also hereby deemed to include a Subcontractor of any tier. The omission of a reference to a Subcontractor in connection with any of the Contractor's responsibilities or obligations shall not

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be construed to diminish, abrogate or limit any responsibilities or obligations of a Subcontractor of any tier under the Contract Documents or the applicable subcontract.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 120 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped; or

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped; or

.3 Because the Construction Manager has not certified or the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4, or because the Owner has not made payment after 14 days written notice of such failure to make payment provided that such failure is not due to a disputed amount, and except to the extent the Owner is excused from timely making all or part of any payment on a Certificate for Payment as per any other provisions of the Contract Documents.

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Notwithstanding the preceding or anything else in the Contract Documents, the Contractor shall not cease or delay the progress of the Work for any reason other than one set forth in Section 9.7, it being agreed that monetary damages shall be an adequate remedy for the Contractor for any breach of this Agreement or the Contract Documents by the Owner.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon 30 days' written notice and opportunity to cure to the Owner, terminate the Contract and recover from the Owner payment for such Work properly performed for which it has not otherwise been compensated, but in no event shall the Owner by liable to the Contractor for any prospective loss, including, but not limited to, termination expenses, loss of anticipated profits, impact damages, unabsorbed overhead, or the like. Notwithstanding the foregoing, any such payments to the Contractor shall be less any setoffs to which the Owner may be entitled as per any other provision of the Contract Documents.

§ 14.1.4 If the Work is stopped for a period of 90 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon 30 additional days' written notice to the Owner, Construction Manager and Architect (during which the Owner shall have the right and opportunity to cure), terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 refuses or fails to supply enough properly skilled workers or proper materials or equipment to complete the Work in a diligent, efficient, timely, workmanlike, skillful, and careful manner;

.2 fails to make payment to Subcontractors or suppliers for materials or labor in accordance with the respective agreements between the Contractor and its Subcontractors or suppliers;

.3 disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority, or its health and safety plan;

.4 otherwise is guilty of substantial breach of or default under a provision of the Contract Documents;

.5 cannot complete the Work within the Contract Time or within the time to which such completion may have been extended; provided, however, that the impossibility of timely completion is, in the Owner's opinion, attributable to conditions within the Contractor's control;

.6 breaches any warranty made by the Contractor under or pursuant to the Contract Documents;

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.7 is or has been unnecessarily or unreasonably or willfully delaying the performance and completion of the Work, or the award of necessary subcontracts, or the placing of necessary material and equipment orders;

.8 refuses to proceed with the Work or extra work when and as directed by the Owner, Construction Manager or Architect;

.9 fails or neglects to complete the Work within the Contract Time or in accordance with the Project, Milestone or construction schedules;

.10 refuses or fails to correct deficient Work performed by it;

.11 the Contractor's progress of the Work is such that the Owner reasonably believes that the Contractor shall not be able to achieve Substantial Completion by the Substantial Completion Date and the Contractor has not delivered and implemented a recovery plan required under the Contract or has not recovered the schedule sufficient to meet the respective Contract Time requirements as required by written notice to the Contractor by the Owner;

.12 disregards the instructions of the Construction Manager, Architect or Owner (when such instructions are based on the requirements of the Contract Documents);

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.13 the Contractor becomes a party to any insolvency proceeding in a capacity as a debtor, and, in the case of any involuntary proceedings only, such proceeding is not stayed or discharged within twenty-five (25) days after the commencement of same;

.14 fails after commencement of the Work to proceed continuously with the construction and completion of the Work for more than 10 days, except as permitted under the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven (7) days' written notice, terminate employment of the Contractor at the expiration of such seven (7) day period, and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient utilizing for such purpose such of the Contractor's plant, materials, equipment, tools and supplies remaining on the site, and also such subcontractors as it may deem advisable, or if may call upon the Contractor's surety at its own expense to do so. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work. Such accounting shall be final, binding and conclusive upon the Contractor, its surety, and any person claiming under or through the Contractor, as to the amount thereof.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 In the event that the Owner declared the Contractor in default of the Work or any part of the Work, the Contractor, in addition to any other liability to the Owner hereunder or otherwise provided for or allowed by law, shall be liable to the Owner for any costs it incurs for additional architectural, engineering and construction management services necessary, in its opinion, because of the default and the total amount of liquidated damages from the date when the Work should have been completed by the Contractor in accordance with the terms hereof to the date of actual completion of the Work, both of which items shall be considered as costs incurred by the Owner in completing the Work and the amount of which may be charged against and deducted out of such monies as would have been payable to the Contractor or its surety if the work had been completed without a default. If the costs of finishing the Work exceed the unpaid Contract balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall, upon application, be certified by the Initial Decision Maker after consultation with the Construction Manager, and this obligation for payment shall survive termination of the Contract.

§ 14.2.4.1 The costs of finishing the Work also include, without limitation, all reasonable attorneys' fees incurred in responding to the default and enforcing the Owner's rights under the Contract Documents, additional title costs, insurance, additional interest because of any delay in completing the Work, and all other direct and consequential damages incurred by the Owner by reason of the termination of the Contractor as stated herein.

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§ 14.2.5 If the Owner wrongfully terminates the Contract for cause, the rights, remedies and obligations of the parties will be the same as if the Owner had terminated the Contract for convenience under Section 14.4.

§ 14.2.6 In the event that the Contractor, or the Contractor's surety, challenges the Owner's termination of the Contract for cause, and the Owner prevails in litigation in connection with such challenge, whether initiated by the Owner or by the Contractor or the Contractor's surety, the Owner shall be entitled to its costs, including reasonable attorney's fees, incurred as a result of such litigation, as part of any judgment against the Contractor or the Contractor's surety. Such costs, including reasonable attorney's fees, shall be deemed a cost of finishing the Work.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine. The Owner shall incur no liability by reason of such suspension, delay, or interruption except that the Contractor may request an extension of its time to complete its Work in accordance with Article 8 hereof.

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§ 14.3.2 The Contract Time shall be adjusted for increases in time caused by suspension, delay or interruption as described in Section 14.3.1. No adjustment shall be made to the extent:

- **.1** that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
- **.2** that an equitable adjustment is made or denied under another provision of this Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the whole or any portion of the Contract for the Owner's convenience and without cause upon not less than seven (7) days' written notice to the Contractor. Notwithstanding any other provision to the contrary in the Contract, the Owner reserves the right at any time and in its absolute discretion to terminate the services of the Contractor or the Work (or a part thereof) by giving written notice to the Contractor. This termination for convenience of the Owner provision allows and authorizes the Owner to terminate this Contract at any time and for any reason whatsoever. This right may be exercised by the Owner in its complete discretion. Termination by the Owner under this Section shall be by Notice of Termination delivered to the Contractor specifying the extent of termination and the effective date.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall immediately and in accordance with instructions from the Owner:

- **.1** cease operations as directed by the Owner in the notice;
- **.2** take actions necessary, or that the Owner may direct, for the protection and preservation of the Work;
- **.3** except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders; and
- **.4** proceed to complete the performance of the Work required under portions of the Contract not terminated, if any.

§ 14.4.3 Upon receipt of written notice of the Owner's exercise of such termination, the Contractor shall, as the Contractor's sole and exclusive remedy, be paid for the Work properly executed in accordance with the Contract Documents prior to the effective date of termination and for items properly fabricated off-site, delivered and stored in accordance with the Owner's instructions or the Contract Documents before such effective date. The Contractor's entitlement to payment for all such work shall be predicated on its performance of such work in accordance with the Contract Documents as certified by the Architect and Construction Manager. The Contractor shall be entitled to no other payment and waives any claim for damages including, but not limited to, lost profits, any prospective loss, underutilization of personnel or equipment, unabsorbed overhead, and any and all items of consequential loss or damage. The Owner shall be entitled to credit against any payment to be made to the Contractor pursuant to this Section 14.4 the following: (1) payments previously made to the Contractor for the terminated portion of the Work; (2) claims which the Owner has against the Contractor under the Contract Documents; and (3) the value of the materials, supplies, equipment, or other items that are to be disposed of by the Contractor that are part of the Contract Sum, multiplied by 15% representing the Contractor's overhead and profit. Notwithstanding the foregoing, in the event of a termination under Section 14.4.1 prior to the issuance of a Notice to Proceed, the Contractor shall not be entitled to any compensation whatsoever.

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§ 14.4.4 The Contractor agrees and acknowledges that payments for the Work have been obtained through obligations or bonds which have been sold after public referendum. In the event the Work is suspended or canceled as a result of the order of any court, agency, department entity or individual having jurisdiction, or in the event the work is suspended or canceled due to the fact that a court, agency, department, entity or individual having jurisdiction has issued an order, the result of which is that the aforesaid obligations or bonds are no longer available for payment for the Work, the Contractor expressly agrees that it shall be solely entitled to payment for Work accomplished until a notice of suspension or cancellation is served upon it. The Contractor expressly waives any and all rights to institute an action, claim, cause of action or similar for any damages it may suffer as a result of the suspension or cancellation of the Work and/or its contract pursuant to this Section.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition. A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. Neither a Request for Information, nor a Construction Change Directive, nor a Change Order, nor a reservation of rights, nor minutes of a meeting, nor a daily report, nor any log entry, nor an Owner's request for or the Contractor's response to a Change Order proposal, nor notice of a potential or future claim shall constitute a Claim.

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§ 15.1.2 Time Limits on Claims

§ 15.1.2.1 Claims by the Contractor must be initiated by written notice to the Owner and the Initial Decision Maker. Claims by the Contractor must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the Contractor first recognizes the condition giving rise to the Claim, whichever is earlier.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by the Contractor must be initiated by written notice to the Owner and to the Architect with a copy sent to the Construction Manager within the time limits set forth in Section 15.1.2.1 above. The purpose of the written notice is to give the Owner prompt opportunity: (a) to cancel or revise orders or directions, change plans, mitigate or remedy circumstances giving rise to the Claim or to take other action that may be desirable; (b) to monitor and verify the facts and circumstances as they occur; and (c) to verify any costs and expenses claimed by the Contractor contemporaneously as they are incurred. Written notice is required whether or not the Owner, Construction Manager or Architect is aware of the facts or circumstances that constitute the basis for the Contractor's Claim, and no action or conduct of the Owner, Construction Manager, Architect or any other person will be regarded as a waiver of such notice requirement except only a written statement to such effect signed by the Owner. Failure of the Contractor to give written notice as required by this Section shall be deemed conclusively to be a waiver and release of any Claim, and such written notice shall be a condition precedent to the Contractor's right to make any Claim arising out of, under or in connection with the Contract or its performance of the Work.

§ 15.1.3.2 Written notice shall contain a heading stating "Notice of Claim" to clearly identify it as such. Such notice shall set forth in detail the circumstances that form the basis for the Claim and shall include the following: (1) a clear statement of the claim, including background and chronology; (2) documentation in support of the claim; (3) documentation in support of claimed damages; and (4) certification by responsible officer of the Contractor. The responsibility to substantiate Claims shall rest with the Contractor. An additional Claim arising from the same occurrence or condition made after the Initial Claim has been implemented by Change Order shall not be considered.

§ 15.1.3.3 The Contractor agrees that it has and will make no claim for damages against the Owner by reason of any act or omission to act by any other Contractor, Separate Contractor or Subcontractors having contracts for performance of any portion of work of the Project or in connection with the Owner's, Architect's or Construction Manager's acts or omissions to act in connection with such other Contractors, Separate Contractors or Subcontractors.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim by the Contractor, except as otherwise agreed in writing or as provided in Section 9.7, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments of undisputed amounts in accordance with the Contract Documents; provided, however, that the Contractor shall use its best efforts to furnish the Architect and Owner, as expeditiously as possible, with notice of any Claim including, without limitation, those in connection with concealed or unknown conditions, once

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such Claim is recognized, and shall cooperate with the Architect and the Owner in any effort to mitigate the alleged or potential damages, delay or other adverse consequences arising out of the condition which is the cause of such a Claim. The Construction Manager will prepare Change Orders and the Architect will issue a Certificate for Payment or Project Certificate for Payment in accordance with the decisions of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost. If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4. The Contractor agrees that an express condition precedent to the Contractor's entitlement to any increase in the Contract Sum shall be full and complete compliance to the satisfaction of the Owner with the requirements of Article 15. The Contractor acknowledges the no damages for delay provisions set forth in Sections 8.3.2 and 15.1.6.1.4 hereof.

§ 15.1.5.1 The Contractor shall not be entitled to any adjustment in the Contract Sum or Contract Time if:

.1 The Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner in respect of Contract Sum and Contract Times by the submission of a bid or becoming bound under a negotiated contract; or

.2 The existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test or study of the site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for the Contractor prior to Contractor's making such final commitment;

.3 The Contractor failed to give the written notice within the time and as required by Section 15.1.2; or

.4 If the Owner and the Contractor are unable to agree on entitlement to or as to the amount or length of any such equitable adjustment in the Contract Sum or Contract Times, a claim may be made therefore as provided in Article 15. However, the Owner, Construction Manager, and Architect shall not be liable to the Contractor for any claims, costs, losses or damages sustained by the Contractor on or in connection with any other project or anticipated project.

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§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Sections 15.1.2 and 15.1.3 shall be given. The Contractor's Claim shall include an estimate of the probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

§ 15.1.6.1.1 An application for extension of time must set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work and the number of days' increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner, Construction Manager or Architect may require including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim for an increase in the Contract Time.

§ 15.1.6.1.2 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor.

§ 15.1.6.1.3 The Contractor agrees that an express condition precedent to the Contractor's entitlement to any extension of the Contract Time shall be full and complete compliance to the satisfaction of the Owner with the requirements of Articles 8 and 15.

§ 15.1.6.1.4 The Owner shall not be liable to the Contractor or any of its Subcontractor or Suppliers for claims, impact costs, extended general conditions or delay damages of any nature caused by or arising out of delay, disruption, interference, inefficiencies, impedance, hindrance, acceleration, resequencing, schedule impacts, lack of timeliness by the Owner or its Architect or Construction Manager, and lack of coordination or scheduling, cumulative impact of multiple change orders, errors or omissions in the design of the Project, delay and other performance impacts. The sole remedy against the Owner for such delays shall be the allowance of additional time for completion of the Work, the amount of which shall be subject to the Claims procedure set forth herein. Except to the extent, if any, expressly prohibited by law, the Contractor expressly agrees not to make and hereby waives any claim for damages for delay, including, but not limited to, those resulting from increased labor or material costs, extended general conditions, directions given or not given by the Owner, Construction Manager, or Architect,

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including scheduling and coordination of the Work; the Architect's preparation of drawings and specifications or the Construction Manager's or Architect's review of shop drawings and requests for instructions; errors or omissions in the design of the Project; or, on account of any delay, disruption, interference, impedance, inefficiency, lack of productivity, obstruction or hindrance for any cause whatsoever by the Owner, Construction Manager, Architect or any other Contractor or Separate Contractor on the Project whether or not foreseeable or anticipated. The Contractor agrees that its sole right and remedy therefore shall be an extension of time, if appropriate. It is emphasized that no monetary recovery may be obtained by the Contractor for delay against the Owner, Construction Manager, Architect, other Contractor or Separate Contractor based on any reason and that the Contractor's sole remedy, if appropriate, is additional time.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction. In planning its construction schedule within the agreed Contract Time, it shall be assumed that the Contractor has anticipated the amount of adverse weather conditions normal to the site of the Work for the season or seasons of the year involved. Only those weather delays attributable to other than normal weather conditions will be considered by the Architect.

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§ 15.1.7 Waiver of Claims for Consequential Damages. The Contractor waives any and all claims for consequential damages of any kind and nature arising out of or relating to this Contract. This waiver of consequential damages shall survive termination of the Contract.

§ 15.1.8 Nothing contained in the Contract Documents shall relieve a Contractor from compliance with any statutory requirement, including, but not limited to those contained in Education Law Section 3813.

§ 15.2 Initial Decision

§ 15.2.1 Claims by the Contractor, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims by the Contractor excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to binding dispute resolution of any Claim. If an initial decision has not been rendered within 30 days after the Contractor's Claim has been referred to the Initial Decision Maker, the Contractor may proceed with binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims by the Contractor and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims by the Contractor, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim by the Contractor or to furnish additional supporting data, such party shall respond, within 10 days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim by the Contractor in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim by the Contractor, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect and Construction Manager, if

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the Architect or Construction Manager is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to binding dispute resolution.

§ 15.2.6 Intentionally omitted.

§ 15.2.6.1 Intentionally omitted.

§ 15.2.7 Intentionally omitted.

§ 15.2.8 If a Claim by the Contractor relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

ARTICLE 16 SPECIAL CONDITIONS

§ 16.1 Equal Opportunity

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§ 16.1.1 The Contractor shall maintain policies for equal employment opportunity for construction employment. During performance of the Agreement, the Contractor agrees as follows:

§ 16.1.2 The Contractor and its Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, or national origin. The Contractor shall take affirmative action to ensure that all applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship and on-the-job training.

§ 16.1.3 The Contractor will post and keep posted in conspicuous places, for employees and applicants for employment, notices obtained by the Contractor from the New York State Division of Human Rights as set forth in the General Regulations of that Division at 9 NYCRR 466.1(a), such conspicuous places to be as defined in 9 NYCRR 466.1(b), and such other postings as that Division may require with respect to New York State's laws, codes, rules, and regulations governing discrimination in employment.

§ 16.1.4 The Contractor will state in all solicitations or advertisements for employees placed by, or on behalf, of the Contractor, that all qualified applicants will be afforded equal employment opportunities without discrimination because of race, creed, color or national origin.

§ 16.1.5 The Contractor will comply with provisions of Sections 290-299 of the Executive Law and with the Civil Rights Law, will furnish all information and reports deemed necessary by the State Commissioner of Human Rights under these non-discrimination clauses and such sections of the Executive Law, and will permit access to the Contractor's books, records and accounts by the Owner, the State Commissioner of Human Rights, the Attorney General and the Industrial Commissioner for the purposes of investigation to ascertain compliance with these nondiscrimination clauses and such sections of the Executive Law and Civil Rights Law.

§ 16.1.6 The Contractor will send to each labor union, or representatives of workers, with which it has, or is bound by a collective bargaining or other Agreement or understanding notices obtained from the State Commissioner of Human Rights, advising such Labor Union or representative of the Contractor's Agreement under requirements of this Article. If the Contractor was directed to do so by Owner as part of the Bid, the Contractor shall request such labor union or representative to furnish him with a written statement that such labor union or representative will not discriminate because of race, creed, color or national origin and that such labor union or representative either will affirmatively cooperate within the limits of its legal and contractual authority in the implementation of the policy and provisions of these non-discrimination clauses or that it consents and agrees that recruitment accordance with the purposes and provisions of these non-discrimination clauses. If such labor union or representative fails or refuses to comply with such a request that it furnish such a statement, the Contractor shall promptly notify the Owner and State Commissioner of Human Rights of such failure or refusal.

§ 16.1.7 The Agreement may be forthwith canceled, terminated or suspended in whole, or in part, by Owner upon the basis of a finding made by the State Division of Human Rights, that the Contractor has not complied with these non-discrimination clauses, and the Contractor may be declared ineligible for future Contracts made by, or in behalf of, the State, or Authority or Agency of the State, or Housing Authority or an Urban Renewal Agency, or Contracts

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requiring the approval of the Commissioner of Housing and Community Renewal, until it has satisfied the State Division of Human Rights, that it has established and is carrying out a program in conformity with the provisions of these non-discrimination clauses. Such findings shall be made by the State Division of Human Rights after conciliation efforts by the Division have failed to achieve compliance with these non-discrimination clauses and after a verified complaint has been filed with the Division, notice thereof has been given to the Contractor, and an opportunity has been afforded by the Contractor to be heard publicly in accordance with the Executive Law. Such sanctions may be imposed and remedies invoked immediately of, or in addition to sanction in remedies otherwise provided by law. If the Agreement is canceled or terminated under provisions of this Article, in addition to other rights of Owner provided in the Agreement upon its breach by the Contractor, the Contractor will hold Owner harmless against any additional expenses or costs incurred by Owner in completing the work or in purchasing the services, materials, equipment or supplies contemplated by Agreement and Owner may withhold payments from the Contractor in an amount sufficient for this purpose and recourse may be had against authority on the Performance Bond if necessary.

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§ 16.1.8 The Contractor will include the provisions of this Article in every subcontract or purchase order in such a manner that such provisions will be binding upon each subcontractor or vendor as to operations to be performed within the State of New York. The Contractor will take such action in enforcing such provisions of such subcontractor or purchase order as the State Division of Human Rights or the Owner may direct, including sanctions or remedies for non-compliance. If the Contractor becomes involved in or is threatened with litigation with a subcontractor or a vendor, as a result of such direction by the State Division of Human Rights, the Contractor shall promptly so notify the Owner and the Attorney General, requesting the Attorney General to intervene and protect the interests of the State of New York.

§ 16.2 Waiver of Immunity

§ 16.2.1 The Contractor hereby agrees to the provisions of Paragraph 139-a and l39-b of the New York State Finance Law and Section 103-a of the New York General Municipal Law, which require that upon the refusal of a person, when called before a grand jury, head of a State department, temporary State commission or other State agency, or the organized crime task force in the Department of Law, which is empowered to compel the attendance of witnesses and examine them under oath, to testify in an investigation concerning any transaction or contract had with the State, any political subdivision thereof, a public authority or with any public department, agency or official of the State or of any political subdivision thereof or of a public authority, to sign a waiver of immunity against subsequent criminal prosecution or to answer any relevant question concerning such transaction or contract.

§ 16.2.1.1 Such person, and any firm, partnership or corporation of which he is a member, partner, director or officer shall be disqualified from thereafter selling to or submitting bids to or receiving awards from or entering into any contracts with New York State or any public department, agency or official thereof for goods, work or services, for a period of five years after such refusal.

§ 16.2.1.2 Any and all contracts made with the State of New York, or any public department, agency or official thereof since the effective date of this law, by such person, and by an firm, partnership or corporation of which he is a member, partner, director or officer may be canceled or terminated by the State of New York without incurring any penalty or damages on account of such cancellation or termination, but any moneys owning by the State of New York for goods delivered or work done prior to the cancellation or termination shall be paid.

§ 16.3 Non-Collusive Clause as Required by NYS General Municipal Law Section 103-d

§ 16.3.1 Every bid or proposal hereafter made to a political subdivision of the state or any public department, agency or official thereof where competitive bidding is required by statute, rule, regulation or local law, for work or services performed or to be performed or goods sold or to be sold, shall contain the following statement subscribed by the bidder and affirmed by such bidder as true under the penalties of perjury: Non-collusive bidding certification.

§ 16.3.2 By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of knowledge and belief, the following:

§ 16.3.2.1 The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competitions, as to any matter relating to such prices with any other bidder or with any competitor.

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§ 16.3.2.2 Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor.

§ 16.3.2.3 No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

§ 16.3.3 A bid shall not be considered for award nor shall any award be made where requirements of this Article have not been complied with; provided however, that in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the bid a signed statement which set forth in detail the reasons therefore. Where requirements of this Article have not been complied with, the bid shall not be considered for award nor shall any award by made unless the head of the purchasing agent of the political subdivision, public department, agency or official thereof to which the bid is made, or his designee, determines that such disclosure was not made for the purpose of restricting competition.

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§ 16.3.4 The fact that a bidder (a) has published price lists, rates, or tariffs covering items being procured, (b) has informed prospective customers of proposed, or pending, publication of new or revised price list for such items, or (c) has sold the same items to other customers at the same prices being bids, does not constitute a disclosure within the meaning of this Article.

§ 16.3.5 Any bid hereafter made to any political subdivision of the state or any public department, agency official thereof by a corporate bidder for work or services performed or to be performed or good sold or to be sold, where competitive bidding is required by statute, rule, regulation, or local law, and where such bid contains the certification referred to in subdivision one of this section, shall be deemed to have been authorized shall be deemed to include the signing and submission of the bid and the inclusion therein of the certificate as to non-collusion as the act and deed of the corporation.

§ 16.4 Assignment of Public Contracts

As provided in Section 109 of the General Municipal Law, the Contractor is prohibited from assigning, transferring, conveying, subletting or otherwise disposing of the same, or of his right title, or interest therein, or his power to execute such contract or any other person or corporation without the previous consent in writing of the officer, board or agency awarding the contract. If any contractor, to whom any contract is let, granted and awarded, as required by law, by any officer, board or agency in a political subdivision, or of any district therein, shall without the previous written consent specified in subdivision one of this section, assign, transfer, convey, sublet or otherwise dispose of such contract, or his right, title or interest therein, or his power to execute such contract, to any other person or corporation, the officer, board or agency which let, made, granted, or awarded such contract shall revoke and annul such contract, and the political subdivision or district therein, as the case may be, and such officer, board or agency shall be relieved and discharged form any and all liability and obligations growing out of such contract to such contractor, and to the person or corporation to which such contract shall have been assigned, transferred, conveyed, sublet or otherwise disposed of, and such contractor, and his assignees, transferees or sublessees shall forfeit and lose all moneys, theretofore earned under such contract, except so much as may be required to pay his employees. The provisions of this section shall not hinder, prevent, or affect an assignment by any such contractor for the benefit of his creditors made pursuant to the laws of this state.

ARTICLE 17 NEW YORK STATE LABOR LAW REQUIREMENTS

§ 17.1 Working Hours

§ 17.1.1 The Contractor specifically agrees as required by the New York State Labor Law ("Labor Law"), Sections 220 and 220-d, as amended, that:

.1 No laborer, worker, or mechanic in the employ of the Contractor, Subcontractor or other person doing or contracting to do the whole or any part of the work included in the Contract Documents shall be permitted or required to work more than eight hours in any one calendar day or more than five (5) days in any one week, except to the extent permitted in the case of extraordinary emergencies described in the Labor Law.

.2 The wages to be paid to each laborer, worker, or mechanic in the employ of the Contractor, Subcontractor, or other person doing or contracting to do all or any part of the work included in the Contract Documents for a legal day's work shall be not less than the prevailing rate of wages as defined by the Labor Law.

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.3 Each laborer, workman or mechanic employed by the Contractor, a Subcontractor, or other person doing or contracting to do all or any part of the work included in the Contract Documents shall be provided the supplements required by Article 8 of the Labor Law.

.4 The minimum hourly rate of wage to be paid shall be not less than that stated in the General Conditions, and shall be as designated by the industrial Commissioner.

.5 The Contractor's and any Subcontractor's or other person's filing of payrolls in a manner prescribed by subdivision 3-a of Section 220 of the Labor Law shall be a condition precedent to the to the Owner's payment of any sums due and owing to the Contractor, Subcontractor or other party for work done on or with respect to the Project.

§ 17.2 Wage Rates

§ 17.2.1 The Contractor specifically agrees, as required by the Labor Law, that the Contract may be forfeited and no sum paid for any work done thereunder on a second conviction for willfully paying less than:

.1 the prevailing wage rates as provided in Labor Law Section 220(3) as amended, or,

.2 the minimum wage rates as provided in Labor Law Section 220-d, as amended.

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§ 17.2.2 The Contractor shall comply with Prevailing Wage Rates as issued by the State of New York Department of Labor for the location and duration of this Project. Current wage rates for this project are included in the Project Manual as part of the Contract Documents. The Contractor is responsible to regularly review "Prevailing Wage Schedules/Updates" available on the "Prevailing Wage/Public Work" link on State of New York Department of Labor "Business in New York" web page (www.labor.state.ny.gov) to identify and implement any applicable changes to Prevailing Wage Rates during the Project.

§ 17.2.3 The Contractor shall comply with all the requirements of the Labor Law Section 220-a, as amended, regarding mandatory submission of certified payroll records, which shall be included with each application for payment.

§ 17.3 Anti-Discrimination

§ 17.3.1 The Contractor specifically agrees, as required by the provisions of Section 220-e of the Labor Law, as amended, that:

.1 In the hiring of employees for the performance of work under the Contract or any subcontract hereunder, no contractor, subcontractor, nor any person acting on behalf of such contractor or subcontractor, shall be reason of race, creed, color, sexual orientation, or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates;

.2 No contractor, subcontractor, nor any person on its behalf, shall in any manner, discriminate or intimidate any employee hired for the performance of work under the contact on account of race, creed, color, sexual orientation, or national origin.

.3 There may be deducted from the amount payable to the Contractor by the Owner under the contract a penalty at fifty dollars for each person for each calendar day during which such person was discriminated against or intimidated in violation of the provisions of the contract; and

.4 The Contract may be canceled or terminated by the Owner, and all monies due or to become due thereunder may be forfeited for a second or any subsequent violation of the terms or conditions of this section of the Contract.

ARTICLE 18 GENERAL MUNICIPAL LAW REQUIREMENTS OF THE STATE OF NEW YORK

§ 18.1 Payment of Contractors and Subcontractors

§ 18.1.1 The Contractor specifically agrees it is bound by Section 106-b of the New York General Municipal Law.

ARTICLE 19 SPECIFIC CONFORMANCE TO THE LAWS OF THE STATE OF NEW YORK

§ 19.1 Statutory Requirements

§ 19.1.1 The parties agree that each is bound to the provisions of the laws of the State of New York governing bidding and contracting for public improvement projects, including but not limited to applicable provisions of the General Obligations Law, Labor Law, and General Municipal Law. To the extent any provisions in the Contract Documents conflict with any provisions of New York Law, the statutory provisions shall prevail and the conflicting provisions in the Contract Documents shall be deemed to conform to the statutory provisions.

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§ 19.1.2 To the extent the laws of the State of New York governing bidding and contracting for public improvement projects mandate inclusion of specific terms in contracts for such improvements, but which are not already included in these General Conditions, such terms shall be deemed and hereby are incorporated into these General Conditions.

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SPECIAL PROVISIONS FOR ALL CONSTRUCTION

These Special Provisions are in addition to the Plans, Specifications, and the other Contract Documents and shall be part of this Agreement. In cases of contradictions, the most stringent Provision shall govern.

A. GENERAL REQUIREMENTS

1. The Contractor is required to name the Construction Manager and the Architect as additional insureds on all casualty and commercial liability insurance coverage required by the Contract Documents, including all primary and excess policies, limits and terms and conditions contained therein, and shall defend, indemnify, and hold harmless the Construction Manager and the Architect to the same extent that the Owner is required to be defended, indemnified, and held harmless under the provisions of the Contract Documents. The Contractor is to provide in addition to the ACORD Form, an executed ISO Endorsement CG 20 38 04 13 (or an equivalent form not requiring a written contract between the insured and additional insureds) naming **The Owner, The Construction Manager and the Architect** as additional insureds. **These requirements will apply to all Shared Services Contracts (Purchase Order Agreements) as well.** In addition, the contractor shall execute written letter agreements in the form annexed hereto confirming such additional insured status.

2. Each Prime Contractor shall provide a full time on site Superintendent or foreman whenever/wherever work is in progress.

3. Each Prime Contractor is responsible for providing their own containers for debris removal, which are to be continuously replaced when full. Waste material is to be deposited in site containers and/or mini-containers, which are provided and disposed by same. All Prime Contractors are responsible to broom clean all areas at the end of each day.

4. All Contractors will be responsible for dust control in connection with their work. Dust control methods to be appropriate for the material to be controlled and the location, subject to the approval of the Owner, and as required by S.E.D.

5. Each Prime is to provide Construction Manager with a list of key personnel (site superintendents and principals) with addresses, telephone and cell numbers for emergency (twenty-four hour) purposes.

6. Provide one (1) week after Notice to Proceed, a cash flow projection for the entire project.

7. All Prime Contractors to provide a list of subcontractors, sub-subcontractors suppliers and vendors with names, addresses, telephone numbers and description of work they shall perform or furnish.

8. Each Prime is to supply, and each employee is to wear, formal ID cards when working on site as per S.E.D. regulations.

9. All Contractors to submit safety plan and corporate safety policy one (1) week after Notice to Proceed. Plan must meet OSHA standards. Owner to receive a copy of each Prime Contractor's safety meeting minutes to be held once a week or as otherwise required. A man signaling movements at all locations shall control movement of trucks and other construction equipment by flags.

10. One (1) week after Notice to Proceed, all Prime Contractors are to submit a "Site Safety and Logistics Plan". Indicate in this plan delivery/removals access and traffic plan, refuse container location, crane/picker/lifts location(s), temp rated plywood/GWB painted partitions separating construction and school areas, staging and storage areas. Construction staging areas shall be as indicated on drawing. Each Contractor shall be allowed to have only one (1) office trailer.

11. Mandatory Construction Manager/Contractor/Architect/Owner coordination meetings will be held once a week. All Prime Contractors are required to attend.

12. Each Prime is responsible for his own storage space at site. Each Contractor will be required to supply and insure storage for their materials. All costs related to delivery, construction, protection, power, etc. are borne by the individual Contractors utilizing space.

13. All Contractors will be required to have a representative on site to accept deliveries of equipment and supplies. Deliveries arriving on site without a Contractor to accept will be turned away. Owner/Construction Manager will not sign delivery tickets.

14. Contractors are to submit Daily Construction Reports to the Construction Manager, detailing manpower and work activities on site. In addition, the Contractors are to submit Two (2) Week Look Ahead Schedules for upcoming work.

15. Schedule of projected fabrication and delivery on long lead items to be submitted one (1) week after Notice to Proceed.

16. Progress/Status reports on fabrication and delivery to be submitted to the Construction Manager every two (2) weeks. 'Rate of Change' chart and marked-up shop drawings to be included in these reports.

17. Disconnect/Tie-In work involving **ANY** utilities that would interfere with the ongoing operations of the building shall be completed on an after-hours basis. Utilities to be restored prior to the opening of the building the following day with adequate time for School District Personnel to prepare the building for normal operations. The Construction Manager is to be notified at least 48 hours in advance.

18. Shop drawings/submittals returned to Contractor for second resubmission require two (2) day turnaround on resubmission. Submittals requiring a second submission may result in charges for additional Architect review time. All returned shop drawings must be resent via **OVERNIGHT PRIORITY DELIVERY, unless as part of a cloud-based submittal system.**

19. Requests for Information are for requests on clarifications or questions on contract drawings and specifications, not contract terms, scheduling items, or general correspondence, or as a means to describe or request approval of alternate construction means, methods or concepts, substitution or materials, systems means and methods. CONTRACTOR is to fill these RFI's out and send them DIRECTLY via fax to the Architect and Construction Manager's office concurrently. Construction Manager will not be responsible for filling these out on Contractor's behalf or their review.. On 'date required' section, fill in exact date, not ASAP or IMMEDIATELY. Should an answer be required immediately, simply place asterisk by date to call attention to such a fact. Each Contractor will be responsible to generate an RFI log and update weekly. Based upon the amount of RFI's received and their level of content, the Architect/Engineer shall establish the level of importance of RFI's and shall be allowed sufficient time, in the Architect/Engineer's professional judgement, to permit adequate review. Prior to submitting any RFI's, the Contractor shall use their discretion in determining whether or not an RFI format or verbal format be used to resolve said situation.

20. Except for the basic building permit, the Prime Contractor's price shall include all fees and other costs for securing and maintaining (by the Prime Contractors or their subcontractors) for the duration of the project; all permits, PE licenses, connection fees (such as electric, gas, telecom utilities, Health Department, Water District etc.), inspections, etc., applicable to, or customarily secured for the Work.

21. Smoking and alcoholic beverages are expressly prohibited on all school properties. All persons representing contractors, subcontractors or

suppliers shall wear photo identification, shirts, long pants and other proper attire while on school property. All persons representing contractors, subcontractors or suppliers shall conduct themselves in a manner consistent with the rules and policies of the New York State Education Department while on school property or otherwise representing this project.

22. The Prime Contractors and their subcontractors are to provide their own protection when they are doing work.

23. The Prime Contractors shall be responsible for any loss or damage to his property or operations. The Prime Contractor will also maintain every precaution to prevent damage to the work of other Prime Contractors and sub contractors during the course of construction. Damage to work of other Prime Contractors and subcontractors will be charges to the offending party(s).

24. The Electrical Prime Contractor shall provide temporary electric light and power services; typical temporary light and power services within all the construction areas and staging areas if power is reasonably accessible. All equipment connections and extensions shall be by all the other Prime Contractors.

25. The Electrical Prime Contractor shall include in their base price the cost to install, maintain and remove all necessary power (filing, trenching, etc.) and telephone / data to the Construction Manager's field office trailer.

26. Final cleaning of the Work is the responsibility of the General Contractor after the other primes remove all of their tools, gang boxes and excess material.

27. Prior to penetrating through wall, decks, and slabs with mechanical fasteners, verify that there are no electrical or mechanical conduit, piping, gas, pneumatic, or water lines in the areas. Contractor will be responsible for damages due to failure to coordinate location of same.

28. All contractors are to take precautions at all times during the progress of the work to prevent water and debris from entering the building due to conditions caused by these operations.

29. Contractor is responsible to mobilize immediately on-site to correct any such infiltration and provide clean-up and restoration. Any costs due to damages will be borne by the responsible Prime contractor.

30. Roofing Contractors will be required to verify the operation of the existing storm drainage system prior to start of construction, and will be

responsible to maintain operation of system components during and after construction. Upon completion of each independent roof area, the contractor is required to schedule and conduct a water flood test per manufacturer's and industry standards.

B. COORDINATION

1. HVAC Contractor is responsible to produce a coordination drawing. Prime Contractors are to first submit their respective shop drawings for approval to the Architect of Record, in order to make any necessary changes prior to going through the coordination process. As each coordination drawing is completed, Contractor is to meet with Owner's Representative and Architect to review and resolve all conflicts on coordination drawing. All coordination meetings will be held at the Construction Manager's site office. The HVAC contractor shall provide temporary filtration and filters, housings to allow the system to be used, if the HVAC system will be used to climatize the building during the work, even if prior to substantial completion.

2. It is the responsibility of the General Contractor to coordinate all sleeves, roof openings, wall openings, etc., with the other Prime Contractors.

3. Each Prime Contractor shall generate a complete "Submittal Log" within one (1) calendar week of Notice to Proceed. This log is to list all required submittals specific to their trade, as detailed in the Project Manual/Specs.

4. Each Prime will be responsible to send all printed shop drawings by hand or OVERNIGHT PRIORITY DELIVERY.

5. Each Prime Contractor is responsible to review and stamp all shop drawings reviewed, prior to submission to the Architect. The Architect will not review any shop drawings unless first reviewed by said Contractor.

6. Submittals must be submitted by each Contractor with a transmittal letter.

7. All submittals that do not meet the above requirements will be immediately returned with no extension of time for required submittal.

    a) General requirements for submittals (or as otherwise directed) will be as follows:

        1) Each Prime Contractor shall submit to the Architect directly one (1) reproducible, and five (5) copies, of shop drawings/product information. In addition, the Prime

Contractor will also send to the Construction Manager, concurrently, one (1) copy of transmittal sent to the Architect.

2) After Architect/Consultant review, Architect will send reviewed documents, concurrently, back to the Contractor and to the Construction Manager.

8. Prime Contractor will be responsible for distribution of their approved drawings/cuts, in a timely manner, to other Prime Contractors and Sub Contractors, for coordination with their work. Any additional cost generated due to lack of transfer of information will be borne by the Contractor responsible for distribution. In the event the Prime Contractor fails to distribute shop drawings/product information to other Prime Contractors, the Owner reserves the right to have the Architect make the necessary copies and ship via overnight delivery to the parties involved. All costs incurred will be backcharged to the Prime Contractor responsible for not distributing shop drawings/product information. The Prime Contractors are responsible for coordinating their work with all other Prime Contractors. No additional cost requests will be considered due to lack of coordination by the Prime Contractors.

9. The Prime Contractor shall be responsible for all cutting, fitting and patching as required to perform the work in accordance with the Contract Documents and project schedule. In the event that others will perform cutting, fitting and patching, these costs shall be charged to the Prime Contractor responsible for the work.

10. Where material is specified to be furnished by others or furnished and delivers only, the Prime Contractor installing the material shall be responsible for scheduling the delivery, receiving, unloading, storing, handling, relocating, hoisting, distribution, laying out and installing. Upon receipt by the Prime Contractor installing the material, risk of loss and damage shall be borne by that contractor.

11. The Prime Contractor is advised to exert utmost care and diligence when working in or near any existing buildings or sitework that is to remain. The absence of protection around such items shall not excuse the Prime Contractor from their liability to provide protection. Any damages to the existing buildings, site work or facilities shall be repaired and expensed to the responsible Prime Contractor.

12. Flagmen shall be provided when work areas impact occupied internal and external areas. This includes, but is not limited to deliveries and equipment movement.

13. Prime contractors are responsible for street closure costs such as police, DOT and other public agencies and oversight, for work that includes, but is not limited to street closures, utilities adjustments, movement of materials, deliveries, etc. This includes all costs and fees associated with these closures.

14. The CM or Architect shall not participate or engage in any physical work which is to be performed by the Contractor. The Contractor shall not request or demand the CM or Architect to perform any physical work.

C. MILESTONE DATES

1. One (1) week after notice to proceed the General Contractor or Lead Prime Contractor, as determined by the Architect and Construction Manager, shall submit a detailed master schedule for review / approval by the Architect and Construction Manager. The Prime Contractor shall include all milestones and long lead items on the schedule. One (1) week after receipt of the preliminary schedule all other Prime Contractors are required to review and comment on the schedule. Upon receipt of all comments, the Prime Contractor responsible for producing the schedule, shall incorporate all changes and distribute copies to all Primes, Architect and Construction Manager, and provide monthly updates.

2. Failure to meet intermediate milestone dates will jeopardize the overall Project Schedule and will mandate Contractor(s) to work overtime at the cost of those Contractor(s) responsible for such delays. In addition, all costs due to delays in completion of the work which require additional Construction Management, Architect, Owner services beyond the work duration in Project Bid Schedule shall be borne by Contractor(s) responsible for delays as per General Conditions of the contract for construction.

3. The Contractor acknowledges that time is of the essence and shall supply substantial and adequate manpower as required to meet the milestone dates. The Owner reserves the right to carry out work or augment labor force as required when, by the Owner's judgment; it becomes apparent that milestone dates may not be met. Any costs will be bourne by the contractor responsible for the delay.

D. SITE ACCESS AND CONTROL

1. The construction personnel shall park in designated locations only.

2. All construction personnel shall wear authorized photo identification badges while on site. The badges shall include a color picture of the employee, employees name, company name and project name.

3. The Prime Contractors, subcontractors and suppliers shall not place signage on any portion of the Project or on any property surrounding the Project.

4. The Prime Contractor is solely responsible for the protection of its own material, equipment, tools and personal belongings while these items are on the premises.

5. The Prime Contractor shall be responsible for securing appropriate space for storing their material on site. Should insufficient space be available on site the Prime Contractor shall store its material off site, any costs associated will be the responsibility of the Prime Contractor. The District or the Construction Manager shall designate all locations for use onsite by the Prime Contractors.

E. TEST/INSPECTIONS

1. If the Architect or Owner determines that in addition to what is specified elsewhere in project manual, any work which requires special inspection, testing or approval, the Construction Manager will instruct the Prime Contractor of such special inspection or testing. If such special inspection or testing reveals a failure of the work to comply with the requirements of the Contract Documents, the Prime Contractor shall bear all costs thereof, including compensation for the Architect, Construction Manager, and Testing Lab.

2. Contractor shall furnish incidental labor to:
    a) Provide access to the work to be tested, sampled, and inspected.
    b) Obtain and handle samples at the project site or at the source of the product to be tested.
    c) Facilitate inspections, samplings, and tests.
    d) Coordinate with the Owner's Representative and testing lab, and submit schedule of required tests one (1) week in advance.
    e) Coordinate inspections with the testing laboratory.

3. The Prime Contractor shall coordinate independent testing and inspections. If any Prime fails to coordinate such inspections and additional costs are incurred to the Owner, the Prime will be responsible for that inspection cost. Architect and Construction Manager shall be notified 48 hours prior to the need of testing. In the event the Contractor

does not give proper notification and the work is done with no test, that Contractor will bear all costs for subsequent testing of installed materials.

4. The CM shall not be responsible for conducting, confirming or verifying the results of any test or procedure performed by the contractor, and will not be deemed the Authority Having Jurisdiction (AHJ). If the CM is requested to witness a procedure on behalf of the Owner, the CM will not bear responsibility for same as noted above.

NOTE: ***All testing costs will be paid for by the Owner, except as noted above or detailed further in the contract documents.***

F. SCHEDULE OF VALUES

1. Within one (1) week after Notice to Proceed, the Prime Contractor shall submit a detailed billing breakdown on AIA G702 form for approval by the Construction Manager. No payments will be made until such billing breakdown is approved.

2. The Schedule of Values will be reviewed and adjusted if necessary. Once approved, the Schedule of Values is to be used for the AIA payment application. The Schedule of Values will take into account and include at minimum the following items divided into separate distinct categories.

    a) Bond/Insurance – 4% of contract sum.
    b) Labor and material on line items as applicable.
    c) Submittals – 1% of contract sum.
    d) Punch List – 3% of contract sum.
    e) Close-Out documents/warranties – 2% of the contract sum.
    f) Supervision and Meetings – 5% of the contract sum
    g) Operating and Maintenance Data
    h) Allowances
    i) Alternates

NOTE: ***Punch List value will be dispersed only when the work has been confirmed to be completed 100%***
The Owner will not reduce or pay any retainage until all work is complete including punch list.

G. PUNCH LIST

1. Upon substantial completion, the Prime Contractors are to submit to the Architect and Construction Manager a letter declaring that the work is substantially complete. Included with the letter is to be the Contractor's

Punch List. Upon the receipt of above, the Construction Manager will schedule with the Owner, Architect, and Contractor, a walk-through to develop a single final Punch List seven (7) days after receipt of notice. This single final Punch List agreed by all parties shall serve as the only Punch List. Upon failure to complete the final Punch List within two (2) weeks from receipt, the Owner reserves the right to complete same and backcharge the costs of material, labor, supervision, and other incidental costs to the Contractor.

H. HOURS OF WORK

1. All Contractors normal work hours shall be weekdays from 7:00 a.m. – 4:00 p.m. The Owner and Construction Manager shall be notified 48 hours in advance of any Contractor's request to work before or after normal work hours or during the weekend or a Holiday. The Contractor shall be responsible for any and all additional costs related to off-hours work to include, but not be limited to, the Owner's Personnel, Construction Manager, Architect, Testing Labs, etc. (at Owner's discretion). Work hours are subject to Town Ordinances and the Owner's schedule.

2. Any work that is required to be performed Monday through Friday in occupied areas of the building or site shall be performed between 3:00 PM and 11:00 PM unless otherwise agreed to, or at a time agreed to on Saturday and Sunday. All such work shall be included in the Contractors' base price and shall appear on the Prime Contractors' detailed work schedules and two-week look-ahead schedules. At the end of each daily work periods, the Prime Contractor shall be responsible for returning these spaces back to their original condition or to a condition previously agreed to by the Owner that will not hinder the regular activities of the Owner.

3. The Prime Contractor must observe any required dates and times when no work activity will be allowed onsite due to the Owner's request and/or activities that take place in the building or on site. Dates and times will be provided as soon as possible during the course of the project.

SCHOOL CONSTRUCTION CONSULTANTS, INC.
190 MOTOR PARKWAY, SUITE 201
HAUPPAUGE, NY 11788

DATE: ____ / ____/ _____
CONTRACTOR: _____
Re: PROJECT: _____
_____

Dear Sir/Madam:
Reference is made to your contract ("contract") with _____ ("Owner") for the above referenced Project. By signing below, you hereby acknowledge and agree, that for valuable consideration, the receipt of which is acknowledged, you covenant and agree that School Construction Consultants, Inc. shall be added as an "additional insured" to your casualty and commercial liability insurance policies required under the Contract, including all primary and excess policies, limits, and terms and conditions contained therein, and further agree that an insurance certificate and endorsement confirming that this entity was added as an "additional insured" on such policies of insurance shall be provided by you prior to the commencement of work on the Project.
In addition, you further covenant and agree to hold harmless, indemnify and defend School Construction Consultants, Inc. to the same extent that you are required to hold harmless, indemnify and defend the Owner under the Contract.
Please acknowledge your consent by signing your name below.
Very truly yours,



William Recce
Principal

Acknowledged and Agreed to by:
_____ as Contractor
Print Name: _____

Title: _____

SCHOOL CONSTRUCTION CONSULTANTS, INC.

Construction Consultation and Management for Educational Facilities

Harrison Central School District
Fitness Center Addition and Alterations

MILESTONE DATES

Bid pick up begins:	Wednesday, June 24, 2026
Pre-bid Walk Thru:	Tuesday, July 7, 2026
Bid Opening:	Thursday, July 23, 2026
Bid Interview:	TBD
Bid Award:	August 6, 2026 (on or about)

All work (Base Bid plus Alternates):

Bonds & Insurances:	(1) week after award*
Submission of Long Lead Item/Priority Submittals:	(1) week after award *
Balance of Submittals:	(30) days after award*
Start Date / Mobilization:	August 17, 2026 (pending insurance approval)
Completion of Site Staging/Enclosures:	August 28, 2026 *
Substantial Completion Date:	October 29, 2027*
Demobilization:	November 12, 2027 *
Punch List Completion Date	November 12, 2027 *
Student Occupancy:	November 15, 2027 *
Final Completion (Close Out):	December 31, 2027*

*** All milestone dates must be met regardless of the actual start / mobilization date.**

Note:

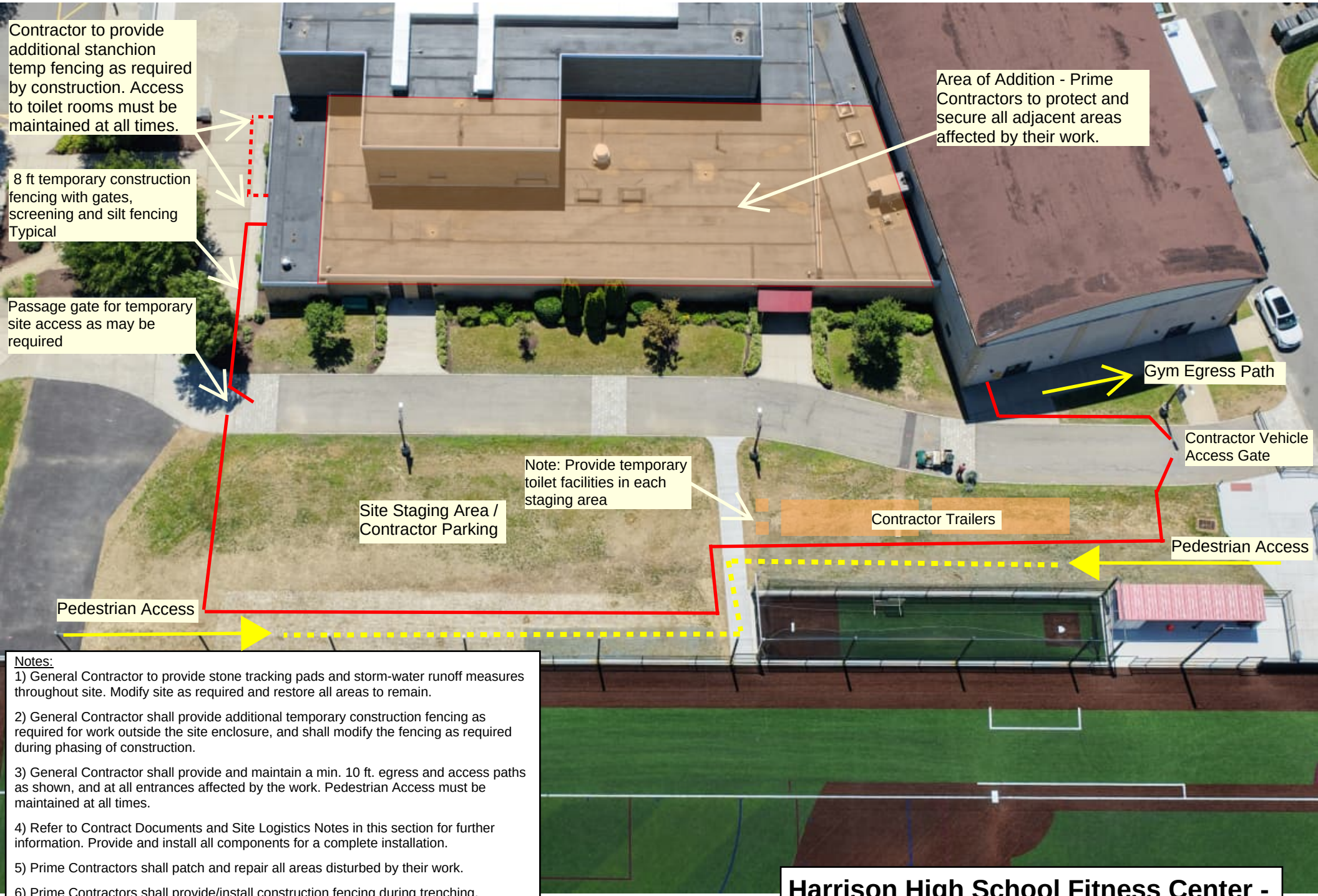
- 48 hours notice must be provided for any work to be scheduled on Saturday and will require approval by the District and SCC in advance
- Working hours will be 7AM-4PM. (Day Work), unless the work impacts school activities / or occurs on school blackout dates. Contractors will then be required to work after-hours as per the Special Provisions.
- Any remaining construction work after August 28, 2027 shall be performed after hours, unless otherwise approved by the Owner.
- All Prime Contractors are responsible to provide the Architect with all the necessary submittals in order to meet all the above milestone dates. The Architect must be given ample time to review the submittals and return.
- All excavation / operations within the building must be performed utilizing non-fossil fuel equipment.
- Please refer to Special Provisions for additional information.

190 Motor Parkway Suite 201 Hauppauge, NY 11788 Tel: (631)567-0200 Fax: (631) 567-6816

Construction Blackout Dates

2026-2027 Exams

Exam	2026-2027 Date
SAT School Day- Seniors *Digital	Proposed: Thursday, October 1st, 2026
ACT In District- Seniors *Online	Proposed: Thursday, October 8th, 2026
PSAT- Juniors *Digital	Proposed: Tuesday, October 27th, 2026
January Regents Algebra I	January 27, 2027
PreACT- Sophomores *Online	TBD - February
SAT School Day- Juniors *Digital	TBD Spring testing window: March 1–April 30, 2027
PSAT10 - Sophomores *Digital	TBD Spring testing window: March 1–April 30, 2027
ACT In District - Juniors *Online	TBD - Spring
IB & AP Testing NYSESLAT	April 27 - May 21
June 2026 Regents	June 25 - June 25



Notes:

1) General Contractor to provide stone tracking pads and storm-water runoff measures throughout site. Modify site as required and restore all areas to remain.

2) General Contractor shall provide additional temporary construction fencing as required for work outside the site enclosure, and shall modify the fencing as required during phasing of construction.

3) General Contractor shall provide and maintain a min. 10 ft. egress and access paths as shown, and at all entrances affected by the work. Pedestrian Access must be maintained at all times.

4) Refer to Contract Documents and Site Logistics Notes in this section for further information. Provide and install all components for a complete installation.

5) Prime Contractors shall patch and repair all areas disturbed by their work.

6) Prime Contractors shall provide/install construction fencing during trenching, installation, and patching for their work outside the construction area - typical. Prime Contractors shall be responsible for markouts prior to excavation.

7) GC to provide/install (3) 8'x 40' Conex type storage containers for District use. The location will be designated by Owner.

Harrison High School Fitness Center - Temporary Site Logistics



NOTE: CONTRACTOR TO PLACESTORAGE CONTAINERS IN THE ENCLOSED COSTRUCTION SITE. ONCE OWNER IS DONE LOADING THE CONTAINERS IT WILL BE THE CONTRACTORS RESPONSIBILITY TO RELOCATE THEM TO THE LONG TERM TEMPORARY STORAGE AREA

PROPOSAL
HARRISON CENTRAL SCHOOL DISTRICT
FITNESS CENTER ADDITION AT
HARRISON HIGH SCHOOL

Contract G – General ConstructionWork
Contract E – Electrical Construction Work
Contract P – Plumbing Construction Work
Contract H – HVAC Construction Work

To: **Harrison Central School District**
The Board of Education
50 Union Avenue
Harrison, New York 10528

For the furnishing and installing of materials for all work included under contract as follows:

Made this _____ day of _____, 2026, by

_____

_____

_____

Bidders Declaration:

The party named as Bidder declares that the only person or persons interested in this bid or proposal as principal or principals is or are named herein; and that no other person than herein named has any interest in this proposal or in the contract proposed to be taken; that this bid or proposal is made without any connections with any other person and persons making a bid or proposal for the same purpose; that the bid or proposal is in all respects fair and without collusion or fraud; that it has examined the site of the work, the contract and specifications and the drawings referred to; and has read the Information for Bidders hereto attached; and it proposes and agrees, if this proposal is accepted, it will contract in the form as approved to perform all the work mentioned in said contract and specifications; and it will accept in full payment therefor the following sums to wit:

PROPOSAL
HARRISON CENTRAL SCHOOL DISTRICT
FITNESS CENTER ADDITION AT
HARRISON HIGH SCHOOL

Note: The bidder is asked to use either black ink or typewriter (black ribbon) in completing this proposal form. Each line item amount must be completed. Failure to do so will be grounds for disqualification of the bidder.

BASE BID: Contract E – Electrical Construction

ITEM 1 – BONDS and INSURANCES

_____ $ _____
WRITTEN IN WORDS

ITEM 2 – DIVISION 1 – GENERAL REQUIREMENTS

_____ $ _____
WRITTEN IN WORDS

ITEM 3 – DIVISION 1 – ELECTRICAL CONSTRUCTION ALLOWANCE

Fourty Thousand Dollars and Zero Cents **$ 40,000.00**
WRITTEN IN WORDS

ITEM 4 – DIVISION 26 – ELECTRICAL

_____ $ _____
WRITTEN IN WORDS

ITEM 5 – DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

_____ $ _____
WRITTEN IN WORDS

ITEM 6 – AS BUILT DRAWINGS

_____ $ _____
WRITTEN IN WORDS

ITEM 7 – PROJECT CLOSEOUT

_____ $ _____
WRITTEN IN WORDS

TOTAL BASE BID (SUM OF ITEMS 1 – 7)

_____ $ _____
WRITTEN IN WORDS

BIDDER'S ACKNOWLEDGEMENTS

THE BIDDER UNDERSTANDS THAT THE OWNER RESERVES THE RIGHT TO WAIVE ANY IRREGULARITIES AND/OR NONCOMPLIANCE WITH THE BID SPECIFICATIONS FOR ANY BID OR BIDS, OR TO REJECT ANY AND ALL BIDS AND RE-ADVERTISE TO INVITE NEW BIDS, OR TO ACCEPT THE WHOLE OR PART OF ANY BID OR BIDS FROM ONE OR MORE BIDDERS, WHICH IN THE OWNER'S JUDGEMENT, IS IN THE BEST INTERESTS OF THE SCHOOL DISTRICT.

THE BIDDER AGREES THAT THE BID SHALL BE GOOD AND MAY NOT BE WITHDRAWN FOR A PERIOD OF FORTY-FIVE (45) CALENDAR DAYS AFTER THE SCHEDULED CLOSING TIME FOR RECEIVING BIDS.

THE BIDDER IS REQUIRED TO VISIT THE SITE FOR A FIELD SURVEY TO VERIFY THE SCOPE OF WORK PRIOR TO BID SUBMISSION.

THE BIDDER HAS SUBMITTED ALL REQUESTS FOR SUBSTITUTIONS, OTHER BRAND NAMES OR PRODUCTS NOT LISTED IN THE SPECIFICATIONS AND RECEIVED IN ACCORDANCE WITH ARTICLE 3, §3.4.2 AND §3.4.2.1, OF THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION.

SITE SUPERVISION

THE SUCCESSFUL CONTRACTOR IS TO PROVIDE FULL TIME SITE SUPERVISION FOR HIS OR HER STAFF, SUBCONTRACTORS AND SUPPLIERS FOR THE DURATION OF THIS PROJECT. A competent superintendent shall be in attendance at the job site at all times when work is being performed under their contract. The superintendent is responsible to visit the job site daily when work is not being performed under their contract and to monitor the overall construction progress. A qualified site superintendent must have the authority to represent and make decisions for his or her company with regards to the subject job, must be able to give guidance and direction to employees, subcontractors and suppliers, and must be knowledgeable about the work to be provided. **FAILURE TO PROVIDE A QUALIFIED SITE SUPERINTENDENT AT THE JOB SITE SHALL SUBJECT SAID PRIME CONTRACTOR TO A PENALTY OF $1,000 PER DAY FOR EVERY OCCURRENCE.**

TIME OF COMPLETION

The Contract award date, project duration, substantial and final completion date, as well as work hours shall be as listed in the *Special Provisions of the Contract for Construction*. Weekend, holiday and evening work is to be provided to ensure this completion date at no additional cost to the Owner. If the building is scheduled to be closed, the contractor shall pay a $60/hour custodial fee for access to the building.

The Board of Education of the Harrison Central Free School District reserves the right to award this contract to other than the low bidder if the law so permits.

ADDENDUM

The undersigned acknowledges receipt of the following addenda (if applicable):

Addendum #	Date	Received by:	Reviewed & Incorporated into Bid by:
_____	_____	_____	_____
_____	_____	_____	_____

The bidder understands that the owner reserves the right to reject any or all bids and to waive any informalities in the bidding.

The bidder agrees that the bid shall be good and may not be withdrawn for a period of **forty-five (45)** calendar days after the scheduled closing time for receiving bids, except in accordance with New York GML §103(11).

The Bidder expressly represents that it has carefully examined and is familiar with the plans, specifications, conditions, requirements, and all addenda issued as part of the Contract Documents, proposal, and the site upon which the work is to be performed. The Bidder certifies that he has previously submitted all requests for substitutions of other brands or products not listed in the specifications and received Architects/Engineers approval on all substituted products being used for this project.

BIDDER'S CERTIFICATION

THE REQUIREMENTS OF THE PROPOSAL HAVE BEEN COMPLETELY READ, UNDERSTOOD AND ACKNOWLEDGED BY THE BIDDER.

Failure of the Contractor to complete work by the specified time shall subject him to liquidated damages as set forth in the General Conditions of these specifications.

Bidder: _____

Bidder Address: _____

Signed By: _____ Title: _____

Date: _____

Provide telephone number where the Contractor or a competent representative can accept a telephone message and provide a reasonable reply as soon as possible, but not later than **Twenty Four (24)** hours:

DAY: (___) _____ NIGHT: (___) _____

FAX: (___) _____ EMAIL: _____

FEDERAL I.D. NO. or SOCIAL SECURITY NO.: _____

PROPOSAL
HARRISON CENTRAL SCHOOL DISTRICT
FITNESS CENTER ADDITION AT
HARRISON HIGH SCHOOL

Note: The bidder is asked to use either black ink or typewriter (black ribbon) in completing this proposal form. Each line item amount must be completed. Failure to do so will be grounds for disqualification of the bidder.

BASE BID: Contract G – General Construction

ITEM 1 – BONDS and INSURANCES

	$
WRITTEN IN WORDS	

ITEM 2 – DIVISION 1 – GENERAL REQUIREMENTS

	$
WRITTEN IN WORDS	

ITEM 3 – DIVISION 1 – GENERAL CONSTRUCTION ALLOWANCE

Seventy-Five Dollars and Zero Cents	**$ 75,000.00**
WRITTEN IN WORDS	

ITEM 4 – DIVISION 1 – UNSUITABLE SOILS ALLOWANCE (EXCAVATION, REMOVAL AND DISPOSAL)

Twenty-Five Thousand Dollars and Zero Cents	**$ 25,000.00**
WRITTEN IN WORDS	

ITEM 5 – DIVISION 1 – DEWATERING ALLOWANCE (WEELLPOINTS, DEC COORDINATION, COLLECTION, STORAGE AND DISPOSAL)

Twenty-Five Thousand Dollars and Zero Cents	**$ 25,000.00**
WRITTEN IN WORDS	

ITEM 6 – DIVISION 1 – ROCKS/STRUCTURAL FILL ALLOWANCE (EXCAVATING, CHIPING, BREAKING AND DISPOSAL)

Thirty Thousand Dollars and Zero Cents	**$ 30,000.00**
WRITTEN IN WORDS	

ITEM 7 – DIVISION 1 – LOCKERS, BENCHES AND EQUIPMENT RELOCATION ALLOWANCE

Fifty Thousand Dollars and Zero Cents	**$ 50,000.00**
WRITTEN IN WORDS	

ITEM 8 – DIVISION 1 – LOGOS AND VINYL WRAP ARTWORK

Twenty Thousand Dollars and Zero Cents	**$ 20,000.00**
WRITTEN IN WORDS	

ITEM 9 – DIVISION 1 – WATERLINE ALLOWANCE

Seven Thousand Five Hundred Dollars and Zero Cents	**$ 7,500.00**
WRITTEN IN WORDS	

ITEM 10 – DIVISION 2 – DEMOLITION

_____ $ _____
WRITTEN IN WORDS

ITEM 11 – DIVISION 3 – CONCRETE

_____ $ _____
WRITTEN IN WORDS

ITEM 12 – DIVISION 4 – MASONRY

_____ $ _____
WRITTEN IN WORDS

ITEM 13 – DIVISION 5 – METALS

_____ $ _____
WRITTEN IN WORDS

ITEM 14 – DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

_____ $ _____
WRITTEN IN WORDS

ITEM 15 – DIVISION 7 – THERMAL AND MOISTURE PROTECTION

_____ $ _____
WRITTEN IN WORDS

ITEM 16 – DIVISION 8 – OPENINGS

_____ $ _____
WRITTEN IN WORDS

ITEM 17 – DIVISION 9 – FINISHES

_____ $ _____
WRITTEN IN WORDS

ITEM 18 – DIVISION 10 – SPECIALTIES

_____ $ _____
WRITTEN IN WORDS

ITEM 19 – DIVISION 14 – CONVEYING EQUIPMENT

_____ $ _____
WRITTEN IN WORDS

ITEM 20 – AS BUILT DRAWINGS

_____ $ _____
WRITTEN IN WORDS

ITEM 21 – PROJECT CLOSEOUT

_____ $ _____
WRITTEN IN WORDS

TOTAL BASE BID (SUM OF ITEMS 1 – 21)

_____ $ _____
WRITTEN IN WORDS

Note: The HARRISON CENTRAL SCHOOL DISTRICT is exempt from Federal, New York State and local taxes. TOTAL AMOUNT BID shall be exclusive of all taxes.

UNIT PRICES

Refer to section 012200. The contract shall include unit prices as herein stated. Should the amount of work required by the contract documents be increased or decreased, the following unit prices shall be used as a basis for computing the cost to the District, or the credit due the District as the case may be, for such increases or decreases in the work. The listed unit prices will also be used for determining the value of quantities included in the specifications. Prices shall reflect the basis for furnishing all labor, material, equipment and other related items necessary for completion of work (in place). The quoted figure shall include contractor's overhead and profit.

The Owner/Architect hereby reserves the right to order any addition or deduction of materials on basis of unit cost figures quoted.

C1	4" thick reinforced poured concrete flatwork, including all form work and preparation	$_____	SF
C2	Excavation and legal disposal of existing earth material (fill/unsuitable material excavation, removal and disposal)	$_____	CY
C3	Removal and replacement of on-site material with engineered fill	$_____	CY
C4	Removal of fill/unsuitable material and blend in place with existing soil as 50% / 50% mix as suitable for controlled fill and compaction	$_____	CY
G1	Hourly rate (prevailing wage) per hour for "laborer" work to be used at the Owners discretion.	$_____	HR

BIDDER'S ACKNOWLEDGEMENTS

THE BIDDER UNDERSTANDS THAT THE OWNER RESERVES THE RIGHT TO WAIVE ANY IRREGULARITIES AND/OR NONCOMPLIANCE WITH THE BID SPECIFICATIONS FOR ANY BID OR BIDS, OR TO REJECT ANY AND ALL BIDS AND RE-ADVERTISE TO INVITE NEW BIDS, OR TO ACCEPT THE WHOLE OR PART OF ANY BID OR BIDS FROM ONE OR MORE BIDDERS, WHICH IN THE OWNER'S JUDGEMENT, IS IN THE BEST INTERESTS OF THE SCHOOL DISTRICT.

THE BIDDER AGREES THAT THE BID SHALL BE GOOD AND MAY NOT BE WITHDRAWN FOR A PERIOD OF FORTY-FIVE (45) CALENDAR DAYS AFTER THE SCHEDULED CLOSING TIME FOR RECEIVING BIDS.

THE BIDDER IS REQUIRED TO VISIT THE SITE FOR A FIELD SURVEY TO VERIFY THE SCOPE OF WORK PRIOR TO BID SUBMISSION.

THE BIDDER HAS SUBMITTED ALL REQUESTS FOR SUBSTITUTIONS, OTHER BRAND NAMES OR PRODUCTS NOT LISTED IN THE SPECIFICATIONS AND RECEIVED IN ACCORDANCE WITH ARTICLE 3, §3.4.2 AND §3.4.2.1, OF THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION.

SITE SUPERVISION

THE SUCCESSFUL CONTRACTOR IS TO PROVIDE FULL TIME SITE SUPERVISION FOR HIS OR HER STAFF, SUBCONTRACTORS AND SUPPLIERS FOR THE DURATION OF THIS PROJECT. A competent superintendent shall be in attendance at the job site at all times when work is being performed under their contract. The superintendent is responsible to visit the job site daily when work is not being performed under their contract and to monitor the overall construction progress. A qualified site superintendent must have the authority to represent and make decisions for his or her company with regards to the subject job, must be able to give guidance and direction to employees, subcontractors and suppliers, and must be knowledgeable about the work to be provided. **FAILURE TO PROVIDE A QUALIFIED SITE SUPERINTENDENT AT THE JOB SITE SHALL SUBJECT SAID PRIME CONTRACTOR TO A PENALTY OF $1,000 PER DAY FOR EVERY OCCURRENCE.**

TIME OF COMPLETION

The Contract award date, project duration, substantial and final completion date, as well as work hours shall be as listed in the *Special Provisions of the Contract for Construction*. Weekend, holiday and evening work is to be provided to ensure this completion date at no additional cost to the Owner. If the building is scheduled to be closed, the contractor shall pay a $60/hour custodial fee for access to the building.

The Board of Education of the Harrison Central Free School District reserves the right to award this contract to other than the low bidder if the law so permits.

ADDENDUM

The undersigned acknowledges receipt of the following addenda (if applicable):

Addendum #	Date	Received by:	Reviewed & Incorporated into Bid by:
_____	_____	_____	_____
_____	_____	_____	_____

The bidder understands that the owner reserves the right to reject any or all bids and to waive any informalities in the bidding.

The bidder agrees that the bid shall be good and may not be withdrawn for a period of **forty-five (45)** calendar days after the scheduled closing time for receiving bids, except in accordance with New York GML §103(11).

The Bidder expressly represents that it has carefully examined and is familiar with the plans, specifications, conditions, requirements, and all addenda issued as part of the Contract Documents, proposal, and the site upon which the work is to be performed. The Bidder certifies that he has previously submitted all requests for substitutions of other brands or products not listed in the specifications and received Architects/Engineers approval on all substituted products being used for this project.

BIDDER'S CERTIFICATION

THE REQUIREMENTS OF THE PROPOSAL HAVE BEEN COMPLETELY READ, UNDERSTOOD AND ACKNOWLEDGED BY THE BIDDER.

Failure of the Contractor to complete work by the specified time shall subject him to liquidated damages as set forth in the General Conditions of these specifications.

Bidder: _____

Bidder Address: _____

Signed By: _____ Title: _____

Date: _____

Provide telephone number where the Contractor or a competent representative can accept a telephone message and provide a reasonable reply as soon as possible, but not later than **Twenty Four (24)** hours:

DAY: (___) _____ NIGHT: (___) _____

FAX: (___) _____ EMAIL: _____

FEDERAL I.D. NO. or SOCIAL SECURITY NO.: _____

PROPOSAL
HARRISON CENTRAL SCHOOL DISTRICT
FITNESS CENTER ADDITION AT
HARRISON HIGH SCHOOL

Note: The bidder is asked to use either black ink or typewriter (black ribbon) in completing this proposal form. Each line item amount must be completed. Failure to do so will be grounds for disqualification of the bidder.

BASE BID: Contract H – HVAC Construction

ITEM 1 – BONDS and INSURANCES

_____ $ _____
WRITTEN IN WORDS

ITEM 2 – DIVISION 1 – GENERAL REQUIREMENTS

_____ $ _____
WRITTEN IN WORDS

ITEM 3 – DIVISION 1 – HVAC CONSTRUCTION ALLOWANCE

Twenty-Five Thousand Dollars and Zero Cents **$ 25,000.00**
WRITTEN IN WORDS

ITEM 4 – DIVISION 1 – COMMISIONING ALLOWANCE

Fifteen Thousand Dollars and Zero Cents **$ 15,000.00**
WRITTEN IN WORDS

ITEM 5 – DIVISION 23 – HEATING. VENTILATING AND AIR CONDITIONING

_____ $ _____
WRITTEN IN WORDS

ITEM 6 – AS BUILT DRAWINGS

_____ $ _____
WRITTEN IN WORDS

ITEM 7 – PROJECT CLOSEOUT

_____ $ _____
WRITTEN IN WORDS

TOTAL BASE BID (SUM OF ITEMS 1 – 7)

_____ $ _____
WRITTEN IN WORDS

BIDDER'S ACKNOWLEDGEMENTS

THE BIDDER UNDERSTANDS THAT THE OWNER RESERVES THE RIGHT TO WAIVE ANY IRREGULARITIES AND/OR NONCOMPLIANCE WITH THE BID SPECIFICATIONS FOR ANY BID OR BIDS, OR TO REJECT ANY AND ALL BIDS AND RE-ADVERTISE TO INVITE NEW BIDS, OR TO ACCEPT THE WHOLE OR PART OF ANY BID OR BIDS FROM ONE OR MORE BIDDERS, WHICH IN THE OWNER'S JUDGEMENT, IS IN THE BEST INTERESTS OF THE SCHOOL DISTRICT.

THE BIDDER AGREES THAT THE BID SHALL BE GOOD AND MAY NOT BE WITHDRAWN FOR A PERIOD OF FORTY-FIVE (45) CALENDAR DAYS AFTER THE SCHEDULED CLOSING TIME FOR RECEIVING BIDS.

THE BIDDER IS REQUIRED TO VISIT THE SITE FOR A FIELD SURVEY TO VERIFY THE SCOPE OF WORK PRIOR TO BID SUBMISSION.

THE BIDDER HAS SUBMITTED ALL REQUESTS FOR SUBSTITUTIONS, OTHER BRAND NAMES OR PRODUCTS NOT LISTED IN THE SPECIFICATIONS AND RECEIVED IN ACCORDANCE WITH ARTICLE 3, §3.4.2 AND §3.4.2.1, OF THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION.

SITE SUPERVISION

THE SUCCESSFUL CONTRACTOR IS TO PROVIDE FULL TIME SITE SUPERVISION FOR HIS OR HER STAFF, SUBCONTRACTORS AND SUPPLIERS FOR THE DURATION OF THIS PROJECT. A competent superintendent shall be in attendance at the job site at all times when work is being performed under their contract. The superintendent is responsible to visit the job site daily when work is not being performed under their contract and to monitor the overall construction progress. A qualified site superintendent must have the authority to represent and make decisions for his or her company with regards to the subject job, must be able to give guidance and direction to employees, subcontractors and suppliers, and must be knowledgeable about the work to be provided. **FAILURE TO PROVIDE A QUALIFIED SITE SUPERINTENDENT AT THE JOB SITE SHALL SUBJECT SAID PRIME CONTRACTOR TO A PENALTY OF $1,000 PER DAY FOR EVERY OCCURRENCE.**

TIME OF COMPLETION

The Contract award date, project duration, substantial and final completion date, as well as work hours shall be as listed in the *Special Provisions of the Contract for Construction*. Weekend, holiday and evening work is to be provided to ensure this completion date at no additional cost to the Owner. If the building is scheduled to be closed, the contractor shall pay a $60/hour custodial fee for access to the building.

The Board of Education of the Harrison Central Free School District reserves the right to award this contract to other than the low bidder if the law so permits.

ADDENDUM

The undersigned acknowledges receipt of the following addenda (if applicable):

Addendum #	Date	Received by:	Reviewed & Incorporated into Bid by:
_____	_____	_____	_____
_____	_____	_____	_____

The bidder understands that the owner reserves the right to reject any or all bids and to waive any informalities in the bidding.

The bidder agrees that the bid shall be good and may not be withdrawn for a period of **forty-five (45)** calendar days after the scheduled closing time for receiving bids, except in accordance with New York GML §103(11).

The Bidder expressly represents that it has carefully examined and is familiar with the plans, specifications, conditions, requirements, and all addenda issued as part of the Contract Documents, proposal, and the site upon which the work is to be performed. The Bidder certifies that he has previously submitted all requests for substitutions of other brands or products not listed in the specifications and received Architects/Engineers approval on all substituted products being used for this project.

BIDDER'S CERTIFICATION

THE REQUIREMENTS OF THE PROPOSAL HAVE BEEN COMPLETELY READ, UNDERSTOOD AND ACKNOWLEDGED BY THE BIDDER.

Failure of the Contractor to complete work by the specified time shall subject him to liquidated damages as set forth in the General Conditions of these specifications.

Bidder: _____

Bidder Address: _____

Signed By: _____ Title: _____

Date: _____

Provide telephone number where the Contractor or a competent representative can accept a telephone message and provide a reasonable reply as soon as possible, but not later than **Twenty Four (24)** hours:

DAY: (___) _____ NIGHT: (___) _____

FAX: (___) _____ EMAIL: _____

FEDERAL I.D. NO. or SOCIAL SECURITY NO.: _____

PROPOSAL
HARRISON CENTRAL SCHOOL DISTRICT
FITNESS CENTER ADDITION AT THE
HARRISON HIGH SCHOOL

Note: The bidder is asked to use either black ink or typewriter (black ribbon) in completing this proposal form. Each line item amount must be completed. Failure to do so will be grounds for disqualification of the bidder.

BASE BID: CONTRACT P – PLUMBING CONSTRUCTION WORK

ITEM 1 – BONDS and INSURANCES

_____ $ _____
WRITTEN IN WORDS

ITEM 2 – DIVISION 1 – GENERAL REQUIREMENTS

_____ $ _____
WRITTEN IN WORDS

ITEM 3 – DIVISION 1 – PLUMBING CONSTRUCTION ALLOWANCE

Twenty-Five Thousand Dollars and Zero Cents **$ 25,000.00**
WRITTEN IN WORDS

ITEM 4 – DIVISION 2 – DEMOLITION WORK

_____ $ _____
WRITTEN IN WORDS

ITEM 5 – DIVISION 22 – PLUMBING

_____ $ _____
WRITTEN IN WORDS

ITEM 6 – AS BUILT DRAWINGS

_____ $ _____
WRITTEN IN WORDS

ITEM 7 – PROJECT CLOSEOUT

_____ $ _____
WRITTEN IN WORDS

TOTAL BASE BID (SUM OF ITEMS 1 – 7)

_____ $ _____
WRITTEN IN WORDS

Note: The HARRISON CENTRAL SCHOOL DISTRICT is exempt from Federal, New York State and local taxes. TOTAL AMOUNT BID shall be exclusive of all taxes.

BIDDER'S ACKNOWLEDGEMENTS

THE BIDDER UNDERSTANDS THAT THE OWNER RESERVES THE RIGHT TO WAIVE ANY IRREGULARITIES AND/OR NONCOMPLIANCE WITH THE BID SPECIFICATIONS FOR ANY BID OR

BIDS, OR TO REJECT ANY AND ALL BIDS AND RE-ADVERTISE TO INVITE NEW BIDS, OR TO ACCEPT THE WHOLE OR PART OF ANY BID OR BIDS FROM ONE OR MORE BIDDERS, WHICH IN THE OWNER'S JUDGEMENT, IS IN THE BEST INTERESTS OF THE SCHOOL DISTRICT.

THE BIDDER AGREES THAT THE BID SHALL BE GOOD AND MAY NOT BE WITHDRAWN FOR A PERIOD OF FORTY-FIVE (45) CALENDAR DAYS AFTER THE SCHEDULED CLOSING TIME FOR RECEIVING BIDS.

THE BIDDER IS REQUIRED TO VISIT THE SITE FOR A FIELD SURVEY TO VERIFY THE SCOPE OF WORK PRIOR TO BID SUBMISSION.

THE BIDDER HAS SUBMITTED ALL REQUESTS FOR SUBSTITUTIONS, OTHER BRAND NAMES OR PRODUCTS NOT LISTED IN THE SPECIFICATIONS AND RECEIVED IN ACCORDANCE WITH ARTICLE 3, §3.4.2 AND §3.4.2.1, OF THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION.

SITE SUPERVISION

THE SUCCESSFUL CONTRACTOR IS TO PROVIDE FULL TIME SITE SUPERVISION FOR HIS OR HER STAFF, SUBCONTRACTORS AND SUPPLIERS FOR THE DURATION OF THIS PROJECT. A competent superintendent shall be in attendance at the job site at all times when work is being performed under their contract. The superintendent is responsible to visit the job site daily when work is not being performed under their contract and to monitor the overall construction progress. A qualified site superintendent must have the authority to represent and make decisions for his or her company with regards to the subject job, must be able to give guidance and direction to employees, subcontractors and suppliers, and must be knowledgeable about the work to be provided. **FAILURE TO PROVIDE A QUALIFIED SITE SUPERINTENDENT AT THE JOB SITE SHALL SUBJECT SAID PRIME CONTRACTOR TO A PENALTY OF $1,000 PER DAY FOR EVERY OCCURRENCE.**

TIME OF COMPLETION

The Contract award date, project duration, substantial and final completion date, as well as work hours shall be as listed in the *Special Provisions of the Contract for Construction*. Weekend, holiday and evening work is to be provided to ensure this completion date at no additional cost to the Owner. If the building is scheduled to be closed, the contractor shall pay a $60/hour custodial fee for access to the building.

The Board of Education of the Harrison Central Free School District reserves the right to award this contract to other than the low bidder if the law so permits.

ADDENDUM

The undersigned acknowledges receipt of the following addenda (if applicable):

Addendum #	**Date**	**Received by:**	**Reviewed & Incorporated into Bid by:**
_____	_____	_____	_____
_____	_____	_____	_____

The bidder understands that the owner reserves the right to reject any or all bids and to waive any informalities in the bidding.

The bidder agrees that the bid shall be good and may not be withdrawn for a period of **forty-five (45)** calendar days after the scheduled closing time for receiving bids, except in accordance with New York GML §103(11).

The Bidder expressly represents that it has carefully examined and is familiar with the plans, specifications, conditions, requirements, and all addenda issued as part of the Contract Documents, proposal, and the site upon which the work is to be performed. The Bidder certifies that he has previously submitted all requests for substitutions of other brands or products not listed in the specifications and received Architects/Engineers approval on all substituted products being used for this project.

BIDDER'S CERTIFICATION

THE REQUIREMENTS OF THE PROPOSAL HAVE BEEN COMPLETELY READ, UNDERSTOOD AND ACKNOWLEDGED BY THE BIDDER.

Failure of the Contractor to complete work by the specified time shall subject him to liquidated damages as set forth in the General Conditions of these specifications.

Bidder: _____

Bidder Address: _____

Signed By: _____ Title: _____

Date: _____

Provide telephone number where the Contractor or a competent representative can accept a telephone message and provide a reasonable reply as soon as possible, but not later than **Twenty Four (24)** hours:

DAY: (___) _____ NIGHT: (___) _____

FAX: (___) _____ EMAIL: _____

FEDERAL I.D. NO. or SOCIAL SECURITY NO.: _____

PROPOSAL
HARRISON CENTRAL SCHOOL DISTRICT
ADDITIONS AND ALTERATIONS AT
HARRISON HIGH SCHOOL

Enclosed in the bid package is a certified check or bid bond for ten percent (10%) of the total amount of each of the school project bid as required by the foregoing "Information for Bidders."

On the signing of such contract by the Bidder, the bidder hereby agrees to furnish the indemnifying bonds as provided in the General Conditions.

The Bidder hereby further agrees that in the event of its failure or refusal to enter into a contract in accordance with this bid within ten (10) business days after due notice from the Board of Education that the contract has been awarded to it and is ready for signature, as given in accordance with the Information for Bidders and/or its failure to execute and deliver the bond for the full amount of the contract price, as provided in said Information for Bidders, the Bidder's check or bid bond which is herewith deposited with the Board shall (at the option of said Board) become due and payable as ascertained and liquidated damages for such default; otherwise, said check or bid bond will be returned to the undersigned.

The full names and residences of all persons and parties interested in the foregoing bid as principals are as follows:

Name	**Address**
_____	_____
_____	_____
_____	_____

Name of Bidder: _____

Business Address of Bidder: _____

_____

NON-COLLUSIVE FORM
BID PROPOSAL CERTIFICATIONS

Firm Name _____

Business Address _____

Telephone Number _____ Date of Bid _____

I. General Bid Certification

The bidder certifies that he will furnish, at the prices quoted, the materials, equipment and/or services as proposed on this Bid.

II. Non-Collusive Bidding Certification

The following statement is made pursuant to Section 103-D of the General Municipal Law, as amended by Chapter 675 of the Laws of 1966, and Section 139-D of the State Finance Law, as amended by Chapter 675 of the Laws of 1966, and Section 2604 of the Public Authorities Law, as amended by Chapter 675 of the Laws of 1966.

By submission of this bid proposal, the bidder certifies that he/she is complying with Section 103-d of the General Municipal Law as follows:

Statement of non-collusion in bids and proposals to political subdivision of the state. Every bid or proposal hereafter made to a political subdivision of the state or any public department, agency or official thereof where competitive bidding is required by statute, rule, regulation, or local law, for work or services performed or to be performed or goods sold or to be sold, shall contain the following statement subscribed by the bidder and affirmed by such bidder as true under the penalties of perjury:

Non-collusive bidding certification.

" (a) By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief:

l. The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;

2. Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and,

3. No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

(b) A bid shall not be considered for award nor shall any award be made where (a) (1) (2) and (3) above have not been complied with; provided, however, that if in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the reasons therefor. Where (a) (1) (2) and (3) above have not been complied with, the bid shall not be considered for award nor shall any award be made unless the head of the purchasing unit of the political subdivision, public department agency or official thereof to which the bid is made or his designee, determines that such disclosure was not made for the purpose of restricting competition.

The fact that a bidder (a) has published price lists, rates, or tariffs covering items being procured, (b) has informed prospective customers of proposed or pending publication of new or revised price lists for such items, or (c) has sold the same items to other customers at the same prices being bid, does not constitute, without more, a disclosure within the meaning of subparagraph one (a).

(c) Any bid hereafter made to any political subdivision of the state or any public department, agency or official thereof by a corporate bidder for work or services performed or to be performed or goods sold or to be sold, where competitive bidding is required by statute, rule, regulation, or local law, and where such bid contains the certifications referred to in subdivision II of this section, shall be deemed to have been authorized by the board of directors of the bidder, and such authorization shall be deemed to include the signing, and submission of the bid and the inclusion therein of the certificate as to non-collusion as the act and deed of corporation.

(d) The person signing this Bid or Proposal certifies that he has fully informed himself/herself regarding the accuracy of the statements contained in this certification, **and under the penalties of perjury**, affirms the truth thereof, such penalties being applicable to the Bidder as well to the person signing in his/her behalf."

Signature of Bidder: _____
(Signature of bidder or authorized representative of a corporation)

Title: _____

Sworn to before me this _____ day of _____, 20___

_____

HOLD HARMLESS AGREEMENT

In accordance with Article 12 of the General Conditions, Indemnification, the Contractor will be required to sign the following "Hold Harmless" Agreement with the BOARD OF EDUCATION. Compliance with the foregoing requirements for insurance shall not relieve the Contractor from liability set forth under the Indemnity Agreement.

The undersigned hereby agrees to defend, indemnify, and save harmless the BOARD OF EDUCATION, its officers and employees from and against any and all liability, loss, damages, claims for bodily injury and/or property damages, cost and expense, including counsel fees, to the extent permissible by law, that may occur or that may be alleged to have occurred in the course of the performance of this agreement by the contractor, whether such claims shall be made by an employee of the contractor or by a third party, the contractor covenants and agrees that he will pay all costs and expenses arising therefrom and in connection therewith, and if any judgment shall be rendered against the Owner, Architect/Engineer & Construction manager, in any such litigation, the Contractor shall at his own expense satisfy and discharge the same.

By: _____
(Signature of Authorized Representative of Corporation)

_____
(Print Name and Title)

_____
(Date)

CERTIFICATION OF COMPLIANCE WITH THE IRAN DIVESTMENT ACT

As a result of the Iran Divestment Act of 2012 (the "Act"), Chapter 1 of the 2012 Laws of New York, a new provision has been added to State Finance Law (SFL) § 165-a and New York General Municipal Law § 103-g, both effective April 12, 2012. Under the Act, the Commissioner of the Office of General Services (OGS) will be developing a list of "persons" who are engaged in "investment activities in Iran" (both are defined terms in the law) (the "Prohibited Entities List"). Pursuant to SFL § 165-a(3)(b), the initial list is expected to be issued no later than 120 days after the Act's effective date at which time it will be posted on the OGS website.

By submitting a bid in response to this solicitation or by assuming the responsibility of a Contract awarded hereunder, each Bidder/Contractor, any person signing on behalf of any Bidder/Contractor and any assignee or subcontractor and, in the case of a joint bid, each party thereto, certifies, under penalty of perjury, that once the Prohibited Entities List is posted on the OGS website, that to the best of its knowledge and belief, that each Bidder/Contractor and any subcontractor or assignee is not identified on the Prohibited Entities List created pursuant to SFL § 165-a(3)(b).

Additionally, Bidder/Contractor is advised that once the Prohibited Entities List is posted on the OGS Website, any Bidder/Contractor seeking to renew or extend a Contract or assume the responsibility of a Contract awarded in response to this solicitation must certify at the time the Contract is renewed, extended or assigned that it is not included on the Prohibited Entities List.

During the term of the Contract, should the School District receive information that a Bidder/Contractor is in violation of the above-referenced certification, the School District will offer the person or entity an opportunity to respond. If the person or entity fails to demonstrate that he/she/it has ceased engagement in the investment which is in violation of the Act within 90 days after the determination of such violation, then the School District shall take such action as may be appropriate including, but not limited to, imposing sanctions, seeking compliance, recovering damages or declaring the Bidder/Contractor in default. The School District reserves the right to reject any bid or request for assignment for a Bidder/Contractor that appears on the Prohibited Entities List prior to the award of a contract and to pursue a responsibility review with respect to any Bidder/Contractor that is awarded a contract and subsequently appears on the Prohibited Entities List.

I, _____, being duly sworn, deposes and says that he/she is the

_____ of the _____ Corporation and that neither

the Bidder/ Contractor nor any proposed subcontractor is identified on the Prohibited Entities List.

_____

SIGNED

SWORN to before me this

_____ day of _____

201___

Notary Public: _____

DECLARATION OF BIDDER'S INABILITY TO PROVIDE CERTIFICATION OF COMPLIANCE WITH THE IRAN DIVESTMENT ACT

Bidders shall complete this form if they cannot certify that the bidder /contractor or any proposed subcontractor is not identified on the Prohibited Entities List. The District reserves the right to undertake any investigation into the information provided herein or to request additional information from the bidder.

Name of the Bidder: _____

Address of Bidder: _____

Has bidder been involved in investment activities in Iran? _____
Describe the type of activities including but not limited to the amounts and the nature of the investments (*e.g.* banking, energy, real estate)_____
_____
_____
_____

If so, when did the first investment activity occur? _____

Have the investment activities ended? _____

If so, what was the date of the last investment activity?_____

If not, have the investment activities increased or expanded since April 12, 2012? _____

Has the bidder adopted, publicized, or implemented a formal plan to cease the investment activities in Iran and to refrain from engaging in any new investments in Iran?_____

If so, provide the date of the adoption of the plan by the bidder and proof of the adopted resolution, if any and a copy of the formal plan. _____

In detail, state the reasons why the bidder cannot provide the Certification of Compliance with the Iran Divestment Act below (additional pages may be attached):
_____
_____
_____
_____
_____
_____

I, _____ being duly sworn, deposes and says that he/she is the _____ of

the _____ Corporation and the foregoing is true and accurate.

_____
SIGNED

SWORN to before me this

_____ day of _____

201___
Notary Public: _____

Sexual Harassment Prevention Certification Form

By submission of this bid, the person signing on behalf of the bidder certifies, under penalty of perjury, that the bidder has and has implemented a written policy addressing sexual harassment prevention in the workplace and provides annual sexual harassment prevention training to all of its employees. Such policy shall, at a minimum, meet the requirements of Section 201-g of the Labor Law.

Bidder Name: _____

Bidder Address: _____

Signature:_____

Print Name and Title: _____

Date: _____

Insurance Certification

Your insurance representative must complete the form below in order to be considered for the award of this bid or project, and it is important that you complete the Bidder's Acknowledgement section of this form. Please note that this Insurance Certification form must accompany your bid submission in order for your bid to be considered.

Insurance Representative's Acknowledgement:
We have reviewed the insurance requirements set forth in the Supplementary Conditions Article 10 & 11 of the specifications and are capable of providing such insurance to our insured in accordance with such requirements in the event the contract is awarded to our insured and provided our insured pays the appropriate premium.

Insurance Representative:

_____

Address:

_____

_____

Are you an agent for the companies providing the coverage? Yes____ No_____

Date _____ _____
: Insurance Representative Signature

Bidder's Acknowledgement:
I acknowledge that I have received the insurance requirements of this bid and have considered the costs, if any, of procuring the required insurance and will be able to supply the insurance required in accordance with the bid, if it is awarded. I understand that this Insurance Certification form must be submitted with my bid and my inability to provide the required insurances may result in the rejection of my bid, and the School District may award the contract to the next lowest/responsive bidder.

Firm name: _____

Address: _____

_____

Date _____
:

_____
Bidder's Signature

DRAFT

AIA® Document A132™ – 2019

Standard Form of Agreement Between Owner and Contractor,
Construction Manager as Adviser Edition

AGREEMENT made as of the _____ day of _____ in the year 2025
(In words, indicate day, month, and year.)

BETWEEN the Owner:
(Name, legal status, address, and other information)

Harrison Central School District
50 Union Avenue
Harrison, NY 10528

and the Contractor:
(Name, legal status, address, and other information)

for the following Project:
(Name, location, and detailed description)

Fitness Center Addition at
Harrison High School
255 Union Ave.
Harrison, NY 10528

The Construction Manager:
(Name, legal status, address, and other information)

School Construction Consultants, Inc.
190 Motor Parkway, Suite 201
Hauppauge, New York 11788

The Architect:
(Name, legal status, address, and other information)

H2M Architects + Engineers
538 Broad Hollow Road, 4th Floor East
Melville, NY 11747

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be used in conjunction with AIA Documents A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition; B132™–2019, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™–2019, Standard Form of Agreement Between Owner and Construction Manager as Adviser. AIA Document A232™–2019 is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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User Notes: (1397978189)

TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

3 DATE OF COMMENCEMENT AND DATES OF SUBSTANTIAL COMPLETION

4 CONTRACT SUM

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8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

DRAFT

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, the Bidding Documents, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contractor represents that it has fully reviewed the Contract Documents and agrees that the Contract Documents describe, to the best of the Contractor's knowledge, the Work necessary to furnish and provide and that the Contractor shall furnish and provide a fully functioning Project consistent with the Contract Documents.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, or reasonably inferable by the Contractor as necessary to produce the results intended by the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others. It is the intent of the parties to include within the Work any and all labor, materials, equipment and services that, although not expressly indicated in the Contract Documents, are reasonably inferable therefrom to construct complete and workable systems for the satisfactory performance, execution, final completion and use of the Work and Project.

ARTICLE 3 DATE OF COMMENCEMENT AND DATES OF SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[« X »] The date of this Agreement.

[« »] A date set forth in a notice to proceed issued by the Owner.

[« »] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work. The provisions of this Contract relating to the time for performance and completion of the Work are of the essence of this Contract. Accordingly, time is of the essence respecting the Contract Documents and all obligations thereunder. The Owner will be entitled to seek liquidated damages for failure to timely achieve Substantial Completion and final completion as set forth herein and in the General Conditions.

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User Notes: (1397978189)

§ 3.3 Substantial Completion of the Project or Portions Thereof

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the date of Substantial Completion of the Work of all of the Contractors for the Project will be:
(Insert the date of Substantial Completion of the Work of all Contractors for the Project.)

All of the Contractors for the Project shall achieve Substantial Completion of the Work in accordance with the schedule set forth in the Project Manual.

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work of all of the Contractors for the Project are to be completed prior to Substantial Completion of the entire Work of all of the Contractors for the Project, the Contractors shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date
Refer to schedule set forth in the Project Manual	

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§ 3.4 When the Work of this Contract, or any Portion Thereof, is Substantially Complete

§ 3.4.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall substantially complete the entire Work of this Contract:
(Check one of the following boxes and complete the necessary information.)

[« »] Not later than « » (« ») calendar days from the date of commencement of the Work.

[« X »] By the following date: in accordance with schedule set forth in the Project Manual.

§ 3.4.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work of this Contract are to be substantially complete prior to when the entire Work of this Contract shall be substantially complete, the Contractor shall substantially complete such portions by the following dates:

Portion of Work	Date to be substantially complete
Refer to schedule set forth in the Project Manual	

§ 3.4.3 Time is of the essence in the performance of the Contract Documents, including, without limitation, the Substantial Completion dates established herein. The Contractor shall proceed expeditiously with adequate forces and shall use its best efforts to keep its Work and the Project on schedule, and the Contractor shall achieve the completion times established within the Contract Documents. Milestone dates set forth in the Project schedule are dates critical to the Owner's operations that establish when the Work or a part thereof is to commence and be complete. All milestone dates are of the essence and shall have the same meaning as Substantial Completion or final completion for the purposes of liquidated damages.

§ 3.4.4 If the Contractor fails to substantially and finally complete the Work of this Contract, or portions thereof, as provided in this Section 3.4.4, liquidated damages shall be assessed as set forth in Section 4.3 herein and Section 8.2.5 of the AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, as modified (the "General Conditions" or "AIA Document A232–2019").

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be one of the following:
(Check the appropriate box.)

[« X »] Stipulated Sum, in accordance with Section 4.2 below

[« »] Cost of the Work plus the Contractor's Fee, in accordance with Section 4.3 below

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[« »] Cost of the Work plus the Contractor's Fee with a Guaranteed Maximum Price, in accordance with Section 4.4 below

(Based on the selection above, complete Section 4.2, 4.3 or 4.4 below.)

§ 4.2 Stipulated Sum

§ 4.2.1 The Contract Sum shall be **One Million Nine Hundred Twelve Thousand Three Hundred Dollars and zero cents ($1,912,300.00)**, subject to additions and deductions as provided in the Contract Documents. See Contractor's Bid Form, which is attached hereto as **Exhibit A**.

§ 4.2.1.1 The Stipulated Sum shall not be adjusted for increased labor or material costs, whether foreseen or unforeseen, which may occur between the date of this Agreement and the Commencement Date, or which may occur between the Commencement Date and the Substantial Completion Date or Dates set forth in this Agreement.

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§ 4.2.2 Alternates

§ 4.2.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.2.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.2.4 Unit prices, if any:
(Identify the item and state the unit price, and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.3 Liquidated Damages. The Contractor recognizes that achieving Substantial Completion of the Work in accordance with the time limits set forth in this Agreement and as further set forth in the Project Manual and/or Bidding Documents is a material condition of this Agreement, and that if the Contractor fails to achieve Substantial Completion of the Work, or designated parts thereof, in accordance with such schedule, the Owner will incur damages as a result. The Owner and Contractor agree that the amount of such damages is difficult to ascertain with any precision. The Owner and Contractor have attempted to estimate reasonable daily figures for liquidated damages, not to penalize the Contractor for late completion, but to reasonably estimate probable losses and damages to the Owner in the event of the late completion. Liquidated damages as used and defined in Section 8.2.5 of the General Conditions, and herein, shall be One Thousand Dollars ($1,000) per calendar day for each day the Project, or a specific Work item, is not substantially complete after expiration of the Contract Time for Substantial Completion, and One Thousand Dollars ($1,000) per calendar day for each day the Project is not finally complete after the expiration of the Contract Time for final completion.

§ 4.3.1 The Contractor acknowledges that the liquidated damages amounts set forth above represent a fair and reasonable estimate of the Owner's probable losses, damages and/or expenses, and are not a penalty, for late completion

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of the Work and the phases thereof.

§ 4.3.2 The Owner shall be entitled to offset any liquidated damages owed by Contractor against any amounts owing by the Owner to the Contractor.

§ 4.3.3 The Owner's right to liquidated damages shall survive abandonment of the Work by the Contractor and the Owner's termination of the Contract.

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Construction Manager by the Contractor, and upon certification of the Project Application and Project Certificate for Payment or Application for Payment and Certificate for Payment by the Construction Manager and Architect and issuance by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

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§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month.

§ 5.1.3 Provided that an acceptable Application for Payment, including all required lien waivers and certified payroll, is received by the Construction Manager not later than the twenty-first (21st) day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the thirtieth (30th) day of the next month. If an Application for Payment is received by the Construction Manager after the application date fixed above, payment of the amount certified shall be made by the Owner not later than 60 days after the Construction Manager receives the Application for Payment.

§ 5.1.4 Progress Payments Where the Contract Sum is Based on a Stipulated Sum

§ 5.1.4.1 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work and be prepared in such form and supported by such data to substantiate its accuracy as the Construction Manager and Architect may require. This schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.4.2 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment. All progress payments made previous to the last and final payment shall be based on estimates and the right is hereby reserved by the Architect for the Owner to make all due and proper corrections in any payment for any previous error.

§ 5.1.4.3 In accordance with AIA Document A232™–2019 and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.4.3.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;

.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.4.3.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A232–2019;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Owner, Construction Manager or Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A232–2019; and

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.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to when the Work of this Contract is substantially complete, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

Five percent (5%)

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

None.

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§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to when the entire Work of this Contract is substantially complete, including modifications for completion of portions of the Work as provided in Section 3.4.2, insert provisions for such modifications.)

No retainage reduction prior to Substantial Completion of the entire Work.

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, when the Work of this Contract is substantially complete, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted when the Work of this Contract is substantially complete shall not include retainage as follows:
(Insert any other conditions for release of retainage when the Work of this Contract is substantially complete, or upon Substantial Completion of the Work of all Contractors on the Project or portions thereof.)

Upon Substantial Completion of the Work, the payment shall be less two times the value of any remaining Work to be completed as the Construction Manager recommends and the Architect determines for incomplete Work and an amount necessary to satisfy any claims, liens or judgments against the Contractor that have not been suitably discharged.

§ 5.2 Final Payment

§ 5.2.1 Final Payment Where the Contract Sum is Based on a Stipulated Sum

§ 5.2.1.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A232–2019 and to satisfy other requirements, if any, which extend beyond final payment;

.2 a final Certificate for Payment or Project Certificate for Payment has been issued by the Architect; and

.3 the Contractor has fully performed and complied with the final payment and closeout provisions of Specifications.

§ 5.2.1.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the final Certificate for Payment or Project Certificate for Payment.

§ 5.3 Payments due and unpaid under the Contract shall bear interest from the date payment is due in accordance with Section 106-b(1)(b) of the New York State General Municipal Law.

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as Initial Decision Maker pursuant to Article 15 of AIA Document A232–2019, as modified.

§ 6.2 Binding Dispute Resolution

For any Claim, dispute or other matter in controversy arising out of or related to the Contract, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

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[« »] Arbitration pursuant to Article 15 of AIA Document A232–2019.

[« X »] Litigation in a court of competent jurisdiction located in Westchester County.

[« »] Other: *(Specify)*

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 Where the Contract Sum is a Stipulated Sum

§ 7.1.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A232–2019, as modified.

§ 7.1.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232–2019, as modified.

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ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A232–2019 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

Timothy P. Whipple
Assistant Superintendent for Business
Harrison Central School District
50 Union Ave
Harrison, NY 10528

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in Article 11 of AIA Document A232–2019 and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in Article 11 of AIA Document A232–2019 and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A232–2019 may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they will endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

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§ 8.7 Intentionally omitted.

§ 8.8 Other provisions:
§ 8.8.1 The Contractor represents and warrants the following to the Owner (in addition to any other representations and warranties contained in the Contract Documents) as an inducement to the Owner to execute this Agreement, which representations and warranties shall survive the execution and delivery of this Agreement, any termination of this Agreement and the final completion of the Work:

.1 that it and its Subcontractors are financially solvent, able to pay all debts as they mature and possessed of sufficient working capital to complete the Work and perform all obligations hereunder;

.2 that it is able to furnish the plant, tools, materials, supplies, equipment and labor required to complete the Work and perform its obligations hereunder;

.3 that it is authorized to do business in the State of New York and the United States and properly licensed by all necessary governmental and public and quasi-public authorities having jurisdiction over it and over the Work and the Project;

.4 that its execution of this Agreement and its performance thereof is within its duly authorized powers;

.5 that its duly authorized representative has visited the site of the Project, is familiar with the local and special conditions under which the Work is to be performed and has correlated on-site observations with the requirements of the Contact Documents; and

.6 that it possesses a high level of experience and expertise in the business administration, construction, construction management and superintendence or projects of the size, complexity and nature of the particular Project, and that it will perform the Work with the care, skill and diligence of such a contractor.

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The foregoing warranties are in addition to, and not in lieu of, any and all other liability imposed upon the Contractor by law with respect to the Contractor's duties, obligations and performance hereunder. The Contractor's liability hereunder shall survive the Owner's final acceptance of and payment for the Work. All representations and warranties set forth in this Agreement, including without limitation, this Section 8.8.1, shall survive the final completion of the Work or the earlier termination of this Agreement. The Contractor acknowledges that the Owner is relying upon the Contractor's skill and experience in connection with the Work called for hereunder.

Upon the execution of this Contract, the Contractor shall, upon request, provide the Owner with unredacted copies of all contracts entered into between the Contractor and subcontractors or material suppliers. The Contractor's obligation to provide the Owner with said contracts shall continue for the duration of the Project.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A132™–2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition

.2 Bidding Documents

.3 AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, as modified

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

N/A

. 5 Drawings

Refer to the attached **Exhibit B, List of Drawings**, all of which drawings listed therein are incorporated herein by reference.

.6 Specifications

Refer to the attached **Exhibit C, Specifications Table of Contents**, all of which sections listed therein are incorporated herein by reference.

.7 Addenda, if any:

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Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits: N/A
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[« »] AIA Document A132™–2019, Exhibit B, Determination of the Cost of the Work

[« »] AIA Document E235™–2019, Sustainable Projects Exhibit, Construction Manager as Adviser Edition, dated as indicated below:
(Insert the date of the E235-2019 incorporated into this Agreement.)

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[« »] The Sustainability Plan:

Title	Date	Pages

[« »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A232–2019 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

Exhibit A Contractor's Bid Form
Exhibit B List of Drawings
Exhibit C Specifications Table of Contents

This Agreement is entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
(Printed name and title)	*(Printed name and title)*

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Exhibit A

Contractor's Bid Form

[Attached]

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Exhibit B

List of Drawings

[Attached]

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Exhibit C

Specifications Table of Contents

[Attached]

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Labor Law 220-i Certification Form

-Sign and Submit with Bid-

By submission of this bid, the person authorized to sign on behalf of the Bidder hereby certifies, under penalty of perjury, that: (i) the Bidder is registered with the New York State Department of Labor pursuant to Section 220-i of the New York Labor Law and (ii) each of the subcontractors engaged by the Bidder for this Project are also registered.

Bidder further represents that it has included with this certification, a copy of the Certificate(s) of Registration issued by the Commissioner of the Department of Labor for the Bidder and each of its subcontractor(s).

Project: _____

Bidder Name (Corporate): _____

Bidder Address: _____

Signature of Corporate Officer: _____

Print Name and Title: _____

Date: _____

Sworn to before me this _____
day of _____, 20____

_____
Notary Public

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AIA® Document A310™ - 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

« »« »
« »

SURETY:
(Name, legal status and principal place of business)

« »« »
« »

OWNER:
(Name, legal status and address)

« »« »
« »

BOND AMOUNT: $ « »

PROJECT:
(Name, location or address, and Project number, if any)

«PWA»
« »
« »

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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User Notes:

Signed and sealed this « » day of « » , « »

« »	
(Contractor as Principal)	*(Seal)*
« »	
(Witness)	*(Title)*
« »	
(Surety)	*(Seal)*
« »	
(Witness)	*(Title)*

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AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)
« »« »
« »

SURETY:
(Name, legal status and principal place of business)
« »« »
« »

OWNER:
(Name, legal status and address)
« »« »
« »

CONSTRUCTION CONTRACT
Date: « »
Amount: $ « »
Description:
(Name and location)
«PWA»
« »

BOND
Date:
(Not earlier than Construction Contract Date)
« »
Amount: $ « »
Modifications to this Bond: « » None « » See Section 16

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:	« »« »	Name and Title:	« »« »

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**
« »
« »
« »

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)
« »
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ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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User Notes: (1798589260)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

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§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

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§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

« »

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:	« »« »	Name and Title:	« »« »
Address:	« »	Address:	« »

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User Notes: (1798589260)

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Payment Bond

CONTRACTOR:
(Name, legal status and address)

« »« »
« »

SURETY:
(Name, legal status and principal place of business)

« »« »
« »

OWNER:
(Name, legal status and address)

« »« »
« »

CONSTRUCTION CONTRACT
Date: « »
Amount: $ « »
Description:
(Name and location)
«PWA»
« »

BOND
Date:
(Not earlier than Construction Contract Date)
« »
Amount: $ « »
Modifications to this Bond: « » None « » See Section 18

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:	« »« »	Name and Title:	« »« »

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

« »
« »
« »

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

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ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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User Notes:
(1783972170)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

- **.1** have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
- **.2** have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

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User Notes: (1783972170)

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- .1 the name of the Claimant;
- .2 the name of the person for whom the labor was done, or materials or equipment furnished;
- .3 a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- .4 a brief description of the labor, materials or equipment furnished;
- .5 the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- .6 the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- .7 the total amount of previous payments received by the Claimant; and
- .8 the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

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User Notes:
(1783972170)

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

« »

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:	« »« »	Name and Title:	« »« »
Address:	« »	Address:	« »

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User Notes: (1783972170)

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AIA® Document G702™ - 1992

Application and Certificate for Payment

TO OWNER:

PROJECT: PWA

APPLICATION NO: 001

Distribution to:
OWNER:
ARCHITECT:
CONTRACTOR:
FIELD:
:

PERIOD TO:

CONTRACT FOR: General Construction

CONTRACT DATE:

PROJECT NOS: / /

FROM CONTRACTOR:

VIA ARCHITECT:

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM	$0.00
2. NET CHANGE BY CHANGE ORDERS	$0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2)	$0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703)	$0.00
5. RETAINAGE:	
a. 0 % of Completed Work (Column D + E on G703: $0.00)=	$0.00
b. 0 % of Stored Material (Column F on G703: $0.00)=	$0.00
Total Retainage (Lines 5a + 5b or Total in Column I of G703)	$0.00
6. TOTAL EARNED LESS RETAINAGE (Line 4 Less Line 5 Total)	$0.00
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate)	$0.00
8. CURRENT PAYMENT DUE	$0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)	$0.00

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	$0.00	$0.00
Total approved this Month	$0.00	$0.00
TOTALS	$0.00	$0.00
NET CHANGES by Change Order		$0.00

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of:
County of:
Subscribed and sworn to before me this day of
Notary Public:
My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED $0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

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AIA® Document G703™ – 1992

Continuation Sheet

AIA Document, G702™–1992, Application and Certification for Payment, or G736™–2009, Project Application and Project Certificate for Payment, Construction Manager as Adviser Edition, containing Contractor's signed certification is attached.
In tabulations below, amounts are in US dollars.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:	001
APPLICATION DATE:	
PERIOD TO:	
ARCHITECT'S PROJECT NO:	

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED FROM PREVIOUS APPLICATION (D + E)	WORK COMPLETED THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D + E + F)	% (G ÷ C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
	GRAND TOTAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00%**	**0.00**	**0.00**

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AIA® Document G704™ – 2000

Certificate of Substantial Completion

PROJECT:
(Name and address)
PWA

PROJECT NUMBER: /
CONTRACT FOR: General Construction
CONTRACT DATE:

OWNER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
FIELD: ☐
OTHER: ☐

TO OWNER:
(Name and address)

TO CONTRACTOR:
(Name and address)

PROJECT OR PORTION OF THE PROJECT DESIGNATED FOR PARTIAL OCCUPANCY OR USE SHALL INCLUDE:

The Work performed under this Contract has been reviewed and found, to the Architect's best knowledge, information and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated above is the date of issuance established by this Certificate, which is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

Warranty **Date of Commencement**

ARCHITECT	BY	DATE OF ISSUANCE

A list of items to be completed or corrected is attached hereto. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment.

Cost estimate of Work that is incomplete or defective: $0.00

The Contractor will complete or correct the Work on the list of items attached hereto within Zero (0) days from the above date of Substantial Completion.

CONTRACTOR	BY	DATE

The Owner accepts the Work or designated portion as substantially complete and will assume full possession at (time) on (date).

OWNER	BY	DATE

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance shall be as follows:
(Note: Owner's and Contractor's legal and insurance counsel should determine and review insurance requirements and coverage.)

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AIA® Document G706™ – 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT: *(Name and address)* PWA	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐ ARCHITECT: ☐
	CONTRACT FOR: General Construction	CONTRACTOR: ☐
TO OWNER: *(Name and address)*	**CONTRACT DATED:**	SURETY: ☐ OTHER: ☐

STATE OF:
COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose

Indicate Attachment ☐ Yes ☒ No

The following supporting documents should be attached hereto if required by the Owner:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

CONTRACTOR: *(Name and address)*

BY: _____
(Signature of authorized representative)

_____
(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:

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AIA® Document G706A™ - 1994

Contractor's Affidavit of Release of Liens

PROJECT: *(Name and address)*

PWA

TO OWNER: *(Name and address)*

ARCHITECT'S PROJECT NUMBER:

CONTRACT FOR: General Construction

CONTRACT DATED:

OWNER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
SURETY: ☐
OTHER: ☐

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.

2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:

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Consent Of Surety to Final Payment

PROJECT: *(Name and address)* PWA	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐ ARCHITECT: ☐
	CONTRACT FOR: General Construction	CONTRACTOR: ☐
TO OWNER: *(Name and address)*	**CONTRACT DATED:**	SURETY: ☐ OTHER: ☐

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above the
(Insert name and address of Surety)

, SURETY,

on bond of
(Insert name and address of Contractor)

, CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

_____
(Surety)

_____
(Signature of authorized representative)

Attest:
(Seal):

_____
(Printed name and title)

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APPENDIX A

Report on Subsurface Soil and Foundation Investigation dated April 19, 2024

Harrison High School
255 Union Avenue
Harrison, New York 10528
CSA Job # 24-26A

CARLIN • SIMPSON & ASSOCIATES, LLC

Consulting Geotechnical and Environmental Engineers

61 Main Street, Sayreville, New Jersey 08872
Tel. (732) 432-5757
Fax. (732) 432-5717

Principal:
Robert B. Simpson, P.E.
Meredith R. Anke, P.E.

Associates:
Michal Wroblewski, P.E.
Catherine K. Andersen, P.E.
Kurt W. Anke
Eric J. Shaw

19 April 2024
Revised 4 March 2026

H2M Architects + Engineers
538 Broad Hollow Rd, 4th Floor East
Melville NY 11747

Attn: Ms. Erika L Murray
Project Manager

Re: Report on Subsurface Soil and Foundation Investigation
Proposed Building Additions at Harrison High School
255 Union Avenue
Harrison, NY (CSA Job #24-26A)

Dear Ms. Murray:

In accordance with our proposal dated 16 February 2024 and your subsequent authorization, we have completed a Subsurface Soil and Foundation Investigation for the referenced site. The purpose of this study was to determine the nature and engineering properties of the subsurface soil and the groundwater conditions for the new construction, to recommend a practical foundation scheme, and to determine the allowable bearing capacity of the site soils.

We understand that the proposed construction will consist of several new building additions. This report has been updated to be in compliance with the 2025 New York State Building Code. To guide us in this study, you have provided us with a plan that indicates the location of the proposed construction.

Our scope of work for this project included the following:

1. Reviewed the proposed layout, the existing site conditions, the expected soil conditions, and planned this study.

2. Retained Environmental Technical Drilling, Inc. to advance three (3) borings at selected locations on the subject site.

3. Retained Traficante Contracting, LLC to perform two (2) test pits at selected locations on the subject site.

4. Laid out the boring and test pit locations in the field, visually identified the soil layers encountered, obtained soil samples, and prepared detailed boring logs, test pit sketches, and a Boring and Test Pit Location Plan.

5. Performed soil identification tests on selected soil samples in our laboratory.

6. Analyzed the field and laboratory test data and prepared this report containing the results of this study.

1.0 SITE DESCRIPTION

The site is located at 255 Union Avenue in Harrison, New York. The existing building is Harrison High School, which is one to two stories. Site grades are relatively flat.

2.0 PROPOSED CONSTRUCTION

We understand that the proposed construction will consist of three new building additions. One addition is located off the north portion of the building. The second addition is located in the western area of the building, and the third addition is located in the east area of the building. The finished floor elevations, building loads, exact locations, and configuration of the new building additions were unknown at the time of writing this report. We anticipate that the finished floor elevation will be the same as the existing building. Site improvements will also include new utilities.

The following evaluation is based on the very limited information that has been provided to our office as of the date of this report. Once the construction plans have been further developed, a copy of the plans should be forwarded to our office so that we can review them along with the recommendations in this report. At that time, any changes or additional recommendations can be provided, if required.

3.0 SUBSURFACE CONDITIONS

To determine the subsurface soil and groundwater conditions at the site, three (3) borings were advanced by Environmental Technical Drilling Inc. at the locations shown on the enclosed Boring & Test Pit Location Plan. The borings were performed using hollow stem augers and split spoon sampling. The borings were completed in March 2024, under the full-time inspection of Carlin-Simpson & Associates. Detailed boring logs have been prepared and are included in this report. Our field engineer visually identified all of the soil samples obtained during the boring operations and selected samples were tested in our laboratory.

In addition, two (2) test pits were performed by Traficante Contracting, Inc. to evaluate the existing building foundation and foundation bearing material at the proposed addition locations. The test pits were performed in March 2024, under full time inspection of Carlin-Simpon & Associates. The locations of the test pits can be found on the attached Boring & Test

Pit Location Plan. Sketches of these test pits have also been prepared and are included in this report.

3.1 Soil and Rock

The soil descriptions shown on the boring logs and test pit sketches are based on the Burmister Classification System. In this system, the soil is divided into three components: Sand (S), Silt ($) and Gravel (G). The major component is indicated in all capital letters, the lesser in lower case letters. The following modifiers indicate the quantity of each lesser component:

Modifier	Quantity
trace (t)	0 -10%
little (l)	10% - 20%
some (s)	20% - 35%
and (a)	35% - 50%

In addition, the Unified Soil Classification System (USCS) has been provided for each of the major soil strata. The subsurface soil conditions encountered in the soil borings and test pits can be summarized as follows:

Stratum 1A Topsoil — At the surface in each of the borings and test pit T-2 is topsoil that ranges from approximately 6 to 8 inches in thickness.

Stratum 1B Concrete — At the surface in T-3 is a reinforced concrete sidewalk that is approximately 5-inches in thickness.

Stratum 2 Existing Fill — Below the topsoil and concrete sidewalk is existing fill that generally consists of loose to medium dense brown, gray coarse to fine SAND, little (to some) Silt, varying amounts of coarse to fine Gravel. Debris consisting of wood was encountered in this stratum. In addition, many cobbles and boulders were noted in the existing fill stratum. At the boring locations this stratum extends to depths ranging from 5’6” to 8’0” below the existing ground surface. Both test pits were terminated in the existing fill stratum at depths of 3’6” and 5’0” below the existing ground surface at the test pit locations.

Stratum 3 Silty Sand [USCS: SM] — Underlying the existing fill in boring SB-3 is medium dense to dense brown or gray coarse to fine SAND, little (to some) Silt, trace (to some) coarse to fine Gravel. This stratum extends to a depth of 10’0” below the existing ground surface.

Stratum 4 Schist, Weathered Bedrock — Beneath the silty sand in boring SB-3 and below the existing fill in borings SB-1 and SB-2 is completely weathered Schist. This layer is soil like in state, however there are denser pockets that likely cannot be conventionally excavated. The weathered rock was encountered beginning at depths of 5’6” to 10’0” below the existing ground surface.

Stratum 5 Schist Bedrock — Each boring was terminated upon auger or spoon refusal on probable harder bedrock at depths ranging from 7'2" to 10'2" below the existing ground surface.

3.2 Groundwater

During this investigation, groundwater was encountered in each of the borings at depths ranging from 5'3" to 6'0" below the existing ground surface. Groundwater was not encountered in either of the test pits which extended to depths of 3'6" and 5'0" below the existing ground surface, in test pits T-2 and T-3 respectively. The boring observations are summarized in Table 1 below.

Based on subsurface observations, groundwater will likely be encountered. In addition, perched or trapped water could be encountered within the existing fill stratum, particularly during wet periods. Where groundwater is encountered during construction, proper groundwater control methods (i.e. sumps and pumps) will be required. Variations in the location of the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, and other factors not immediately apparent at the time of this exploration.

3.3 Bedrock

Completely weathered Schist bedrock was encountered in each boring location beginning at depths ranging from 5'6" to 10'0" below the existing ground surface. Auger refusal on probable harder Schist bedrock was encountered at depths ranging from 7'2" to 10'2" below the ground surface. The bedrock observations are summarized in Table 1 of this report.

Penetration into the bedrock with excavation equipment will depend on the degree of weathering and fracturing in the rock. The upper few feet of rock may be "rippable" by using large construction equipment, but we anticipate that the "rippability" of the bedrock will be variable and limited. It should not be assumed that the completely weathered rock (very dense material in a soil-like state) can be excavated with conventional equipment. Based on the planned excavation depths, harder rock may be encountered in areas, and the use of hydraulic hammers will be required to excavate the harder, intact bedrock.

3.4 Summary of the Boring & Test Pit Observations

A summary of the boring and test pit observations performed at the referenced site is provided in Table 1 below.

Table 1 – Summary of Boring and Test Pit Observations

Boring / Test Pit No.	Depth to Groundwater	Depth to Bottom of Existing Fill	Depth to Probable Bedrock
SB-1	6'0"	8'0"	CWR @ 8'0" AR @ 8'2"

Boring / Test Pit No.	Depth to Groundwater	Depth to Bottom of Existing Fill	Depth to Probable Bedrock
SB-2	5’3”	5’6”	CWR @ 5’6” AR @ 7’2”
SB-3	5’3”	6’0”	CWR @ 10’0” AR @ 10’2”
T-2	NE to 3’6”	Greater than 3’6”	NE to 3’6”
T-3	NE to 5’0”	Greater than 5’0”	NE to 5’0”

NE – Not Encountered
CWR – Depth to Completely Weathered Rock
AR – Auger Refusal on Probable Harder Bedrock

4.0 SUMMARY OF DESIGN RECOMMENDATIONS

Below is a summary of the major design and construction considerations for the proposed construction. Additional recommendations are provided in the following sections of this report.

- *Subsurface Conditions (Section 3.0)*
  - Existing fill was encountered in the borings to depths ranging from 5’6” to 8’0” below the existing ground surface. The existing fill extends deeper than 3’6” and 5’0” below the existing ground surface at the test pit locations T-2 and T-3, respectively.
  - Groundwater was encountered in each of the borings at depths ranging from 5’3” to 6’0” below the existing ground surface. Groundwater was not encountered in either of the test pits to depths of 3’6” and 5’0” below the existing ground surface, in test pits T-2 and T-3, respectively.
  - Completely weathered rock was encountered in each boring location beginning at depths ranging from 5’6” to 10’0” below the existing ground surface.
  - Auger refusal on probable harder bedrock was encountered at depths ranging from 7’2” to 10’2” below the ground surface.
  - Two test pits (T-2 and T-3) were performed to evaluate the existing building foundation and foundation bearing material.
  - A summary of the subsurface observations is provided in Table 1 above.

- *New Foundation Recommendations (Section 5.2)*
  - Where rock and soil exist at the foundation bearing elevation, “Special Construction Procedures” must be followed.
  - The building addition foundations, where they are adjacent to the existing building must bear at the same elevation as the existing building footings. In the event that the building addition foundations will bear at a lower elevation, the existing building will need to be underpinned.
  - The new foundations may be designed as spread footing type foundations bearing on virgin soil, engineer-approved compacted fill, or weathered rock.
  - Net design bearing pressure is 4,000 psf.
  - Minimum depth for frost protection is 42 inches.

- *Building Floor Slab Recommendations (Section 5.3)*
  - In our opinion, the existing fill can be densified in place for support of the new floor slab.
  - New structural fill, densified existing fill, and virgin soil are suitable for support of the proposed floor slab.
  - Modulus of subgrade reaction is 200 pci.

5.0 BUILDING ADDITION EVALUATION

We understand that the proposed construction will consist of three new building additions. One addition is located off the north portion of the building. The second addition is located in the western area of the building. And the third addition is located in the east wing of the building. The finished floor elevations, building loads, exact locations, and configuration of the new building additions were unknown at the time of writing this report. We anticipate that the finished floor elevation will be the same as the existing building. A summary of the boring and test pit observations is provided in Table 1 above.

The new building addition foundations adjacent to the existing building must bear at the same elevation as the existing building foundations. Two test pits (T-2 and T-3) were performed to evaluate the foundation and foundation bearing conditions of the existing building near the proposed addition areas. The results of these test pits can be found in Section 5.1 below.

Existing fill was encountered throughout the proposed addition areas to depths ranging from 5’6” to 8’0” below the existing ground surface. The depth and extent of the existing fill is expected to be variable and may be deeper or shallower in unexplored areas of the additions. The existing fill is not an acceptable bearing material for the new building addition foundations. The consistency and density of the soil fill are not predictable. Certain areas may contain clean dense soils while other areas may contain loose material, void spaces, and/or debris. The existing soil fill creates the possibility of intolerable differential settlements under loading.

Groundwater was encountered in each of the borings at depths ranging from 5’3” to 6’0” below the existing ground surface. Groundwater will likely be encountered during construction. Proper groundwater control (i.e. sumps and pumps) will be required where groundwater is encountered. In addition, handling wet and sensitive subgrades will be required in the event that the groundwater destabilizes the foundation subgrade. Additional information can be provided upon request, once there is more information about the new building additions.

New engineer-approved compacted fill, virgin soil, weathered rock, or bedrock can adequately support the new building additions’ foundations. Foundation recommendations for the building addition are provided in Section 5.2 below. In our opinion, the existing fill can be compacted in place for support of the new floor slab. The proposed building addition floor slabs may be designed as slab on grade bearing on new compacted fill, densified existing fill or densified virgin soils. Floor slab recommendations can be found in Section 5.3 below.

Once the plans have been further developed, they should be forwarded to this office so that additional geotechnical construction recommendations can be made. Additional

recommendations may include, building addition area preparation, recommendations on handling groundwater and wet subgrades, and special bedrock procedures.

5.1 Existing Building Evaluation

Two test pits were performed to evaluate the foundation and foundation bearing conditions of the existing building near the proposed addition areas. Sketches of these test pits (Figure 2 and 3) can be found attached to this report. Below is a summary of test pit observations.

Test pit T-2 was performed in the northern portion of the site at a location that was selected by H2M Architects + Engineers. Test pit T-2 revealed that the building at this location is bearing on a concrete grade beam that extends approximately 3'6" below the existing ground surface. The grade beam is bearing on existing fill. The existing fill at the foundation or grade beam bearing elevation could be probed 24-inches. This indicates that the soils are loose. Based on the nearby boring SB-2 and the findings of the test pit T-2, we can approximate that the existing grade beam is bearing on about 2-feet of existing fill. Groundwater was not encountered in test pit T-2 to a depth of 3'6" below the existing ground surface.

Test pit T-3 was performed in the eastern portion of the site at a location that was selected by H2M Architects + Engineers. The building at this location is supported by a concrete grade beam that is bearing on existing fill. The concrete grade beam extends about 5'0" below the existing ground surface. The existing fill at the bottom of the foundation or grade beam could be probed 12 to 18 inches. This indicates that the soils are loose. Based on the nearby boring SB-3 and the findings of the test pit T-3, we can approximate that the existing grade beam is bearing on about 1 to 1.5-feet of existing fill. Groundwater was not encountered in test pit T-3 to a depth of 5'0" below the existing ground surface.

5.2 New Building Foundations

The new foundations may be designed as shallow spread foundations lower to bear on virgin site soils, new structural fill, weathered rock, or bedrock.

Bedrock Special Construction Procedures

In the event that both soil and rock are encountered within the foundation excavations, "Special Construction Procedures" must be employed. When continuous wall footings or closely spaced column footings bear on dissimilar material (i.e. rock and soil), the potential for differential movement exists. A footing bearing in rock will not move, whereas a footing bearing on soil will settle slightly due to the compressive nature of all soils when subjected to new loads. The area between movement and non-movement will develop a (shear) stress point, which could cause cracks in foundations and walls. In order to avoid this, "Special Construction Procedures" must be used. The need for and extent of "Special Construction Procedures" must be evaluated in the field on a case-by-case basis by Carlin-Simpson & Associates or qualified geotechnical engineering firm at the time of construction. Depending on the subsurface conditions and the foundation layout, additional settlement analysis and evaluation may also be required.

Foundation Design Parameters

The new building addition foundations may be designed as shallow spread footings using the net design bearing pressure as listed in Table 2 below. All of the exterior footings shall bear at the minimum depth listed below for protection from frost. Interior column footings must also bear on virgin soil or new structural fill as described above. The footings shall have minimum dimensions as listed below.

Table 2 – New Foundation Design Parameters

Description	Value
Foundation Bearing Material	Virgin Soil/ New Compacted Fill/ Weathered Rock/ Bedrock
Net Design Bearing Pressure	4,000 psf
Minimum Frost Depth	42 inches
Minimum Column Footing Dimension	30 inches
Minimum Wall Footing Dimension	18 inches

The excavations for the new foundations shall be performed under the full-time inspection of Carlin-Simpson & Associates or a qualified geotechnical engineering firm. The on-site representative shall confirm that the foundation bearing material is capable of supporting the design bearing pressure.

Prior to the placement of formwork, reinforcement steel, and concrete, the bearing subgrade soil shall be cleaned of all loose soil and where soil is encountered at the subgrade elevation, it shall be compacted with several passes of a small vibratory drum trench compactor (i.e. Wacker Model RT560), a heavy vibratory plate tamper (i.e. Wacker BPU 3545A or equivalent), or "jumping jack" style tamper (i.e. Wacker Model BS 600). This must be performed under the observation of Carlin-Simpson & Associates or a qualified geotechnical engineering firm. If instability is observed during the compaction of the bearing subgrade, the soft soil shall be removed and replaced with new compacted fill.

New Footings Adjacent to Existing Foundations

Where the new footings are planned adjacent to the existing building foundations, the new foundation shall bear at the same elevation as the existing footings. This is required to ensure that the new foundation does not surcharge the existing foundations, to ensure that the new foundation does not bear on fill placed around the existing foundations, and to make sure that the existing building is not undermined. In the event that new footings will bear at a lower elevation than the adjacent existing foundations, underpinning of the existing foundations will be required.

5.3 Floor Slab on Grade

In our opinion, the existing fill can be compacted in place for support of the new floor slab. During the preparation of subgrade for the building area if instability is noted by Carlin-

Simpson & Associates or qualified geotechnical engineer, the existing fill may be partially removed and replaced with new compacted fill for support of the new floor slab.

In the event that new fill is required to achieve the floor slab subgrade elevation, it shall consist of either suitable on-site soil or imported sand and gravel. The new fill shall be placed in layers not exceeding one (1) foot in loose thickness and each layer shall be compacted to at least 92% of its Maximum Modified Dry Density (ASTM D1557). Fill layers shall be compacted, tested, and approved before placing subsequent layers. In the event that imported sand and gravel is required it shall meet the following specified gradation:

US Standard Sieve Size	Percent Finer By Weight
3-inch	100
No. 4	30-80
No. 40	10-50
No. 200	0-20

The floor slab may be designed as a slab on grade bearing on densified virgin soil, densified existing fill, completely weathered rock, bedrock, or new engineer-approved structural fill. Floor slab design parameters are provided in Table 3 below. A layer of 3/4-inch crushed stone is recommended beneath the concrete slab for additional support and drainage.

Table 3 – Building Floor Slab Design Parameters

Description	Value
Slab Subgrade Material	Densified Virgin Soil/ Densified Existing Fill/ New Structural Fill/ Weathered Rock/ Bedrock
Modulus of Subgrade Reaction (k)	200 pci
Crushed Stone Cushion Thickness	6 inches

5.4 Settlement

Settlement of individual footings, designed in accordance with recommendations presented in this report, is expected to be within tolerable limits for the proposed structure. For footings placed on natural soils or new engineer-approved compacted fill and constructed in accordance with the requirements outlined in this report, maximum total settlement is expected to be on the order of 1-inch or less. Maximum differential settlement between adjacent columns or load bearing walls is expected to be ½-inch or less.

The above settlement values are based on our engineering experience with similar soil conditions and the anticipated structural loading. These estimated settlements are intended to guide the structural engineer with their design. It is critical that Carlin-Simpson & Associates or a qualified geotechnical engineering firm be retained to observe the foundation bearing surfaces and to confirm the recommended bearing pressures during construction.

5.5 Seismic Design Considerations

New structures should be designed to resist stresses produced by lateral forces computed in accordance with Section 1613 of the 2025 New York State Building Code and ASCE 7-22. From site-specific test boring data, the Site Class was determined from the 2025 New York State Building Code and ASCE 7-22. The site-specific data used to determine the Site Class included soil test borings to determine Standard Penetration resistances (N-values).

For this project, the shear wave velocities were estimated using empirical correlations with site-specific geotechnical parameters, including SPT blow counts. As per ASCE 7-22 Section 20.3, shear wave velocities derived from correlations are subject to uncertainty. To account for the uncertainty the site classes were evaluated using a lower-bound estimate ($V_s/1.3$), the calculated average value (V_s), and an upper-bound estimate ($1.3V_s$). These values correspond to site classes D, CD and C, when compared to the site class boundaries provided in Table 20.2-1.

According to ASCE 7-22 Section 11.4.5, where a design response spectrum is required, a Multi-Period Design Response Spectrum shall be used. According to Section 20.3, the most critical of the site classes for ground motion analysis at each period shall be determined from the lower bound estimate, average value, and upper bound estimate.

The values presented in Table 4 below can be used by the structural engineer to develop the Multi-Period Design Response Spectrum. The most critical values (highest values) for the relevant periods shall be used.

Table 4 – Multi-Period Design Response Spectrum Values

	Site Class D	Site Class CD	Site Class C
T(s)	S_a(g)	S_a(g)	S_a(g)
0	0.13	0.13	0.13
0.01	0.14	0.14	0.14
0.02	0.21	0.21	0.21
0.03	0.24	0.24	0.26
0.05	0.29	0.29	0.31
0.075	0.29	0.3	0.33
0.1	0.29	0.3	0.32
0.15	0.26	0.27	0.27
0.2	0.23	0.22	0.2
0.25	0.2	0.19	0.16
0.3	0.17	0.17	0.14
0.4	0.14	0.14	0.11
0.5	0.13	0.12	0.088
0.75	0.092	0.08	0.059
1	0.071	0.06	0.043
1.5	0.042	0.036	0.027
2	0.028	0.025	0.019

	Site Class D	Site Class CD	Site Class C
T(s)	S_a(g)	S_a(g)	S_a(g)
3	0.015	0.014	0.01
4	0.0098	0.0092	0.007
5	0.0069	0.0066	0.005
7.5	0.004	0.0037	0.0028
10.0	0.0025	0.0024	0.0018

Where the selected structural analysis procedure permits the use of a Two-Period Design Response Spectrum, the seismic parameters provided in Table 5 may be used for design.

Table 5 – Two-Period Design Response Spectrum Values*

Description	Value
Site Classification	D
Site Latitude	40.981372° N
Site Longitude	-73.737138° W
Mapped Spectral Response Acceleration for Short Periods	S_S=0.270g
Mapped Spectral Response Acceleration at 1-Second Period	S_1=0.051g
Max Considered Earthquake Spectral Response for Short Periods	S_{MS}=0.310g
Max Considered Earthquake Spectral Response at 1-Second	S_{M1}=0.110g
Design Spectral Response Acceleration for Short Periods	S_{DS}=0.200g
Design Spectral Response Acceleration for 1-Second Period	S_{D1}=0.071g
Peak Ground Acceleration Adjusted for Site Class (PGA_m)	0.17 g

*The above design values are based on the 2025 New York State Building Code and were obtained from ASCE Hazard Tool website.

We expect that the proposed structure will have a Risk Category of III. Based on this assumption and the above Seismic Design Values, the Seismic Design Category (SDC) for the structure is B. The Risk Category and SDC should be verified by the project structural engineer. In the event that the structure has a different Risk Category, the SDC should be updated by the structural engineer in accordance with Section 1613 of the 2025 New York State Building Code and ASCE 7-22.

Liquefaction Potential

Liquefaction is a phenomenon in which saturated or partially saturated soils lose strength and stiffness when subjected to earthquake-induced ground shaking. Ground shaking of sufficient duration results in the loss of grain-to-grain contact and collapse of the soil skeleton which causes stresses in the soil to be completely transferred to the pore water fluid. Liquefaction is most often observed in saturated, loose sandy soils at depths shallower than 50 feet below the ground surface. Factors known to influence liquefaction potential include composition and thickness of soil layers, grain size, relative density, groundwater level, degree of saturation, and both intensity and duration of ground shaking.

The liquefaction potential was evaluated with the available data, including the SPT blow counts, soil classification, total unit weight, soil fines content, and depth to groundwater. We have determined the potential for liquefaction is negligible for the site and is unlikely to occur during a seismic event.

6.0 SITE EVALUATION

Our recommendations for the proposed site development including new utilities, temporary excavation and bracing, and suitability of the existing site soil for reuse are provided below. A summary of the boring observations is provided in Table 1 above.

6.1 Utilities

New utilities may bear in the densified existing fill, virgin site soils, new compacted fill, weathered bedrock or bedrock. The bottom of all trenches should be excavated clean and shaped so a hard bottom is provided for the pipe support. If any soft or unsuitable soil conditions are encountered during construction, the unsuitable materials must be removed and replaced with new compacted fill.

For areas where existing fill is encountered within the utility excavations, the subgrade at bottom of the utility excavation shall be compacted in place with a vibratory drum trench compactor or "jumping jack" style tamper. Carlin-Simpson & Associates or a qualified geotechnical engineering firm must evaluate these areas for the presence of soft or unsuitable material within the existing fill matrix. If instability is observed, portions of this fill may have to be removed and replaced with new compacted fill. Carlin-Simpson & Associates or a qualified geotechnical engineering firm will determine this during construction.

Rock removal or trench hammering may be required to install the new utilities in portions of the site where rock is encountered above the planned utility invert elevation. Where rock is encountered in the utility excavations, it must be removed to at least six (6) inches below planned pipe invert. The over-excavated six (6) inches shall then be filled with new sandy fill and compacted to at least 92% of its Maximum Modified Dry Density (ASTM D-1557) to act as a cushion on the rock.

In the event that water is encountered within the utility trench excavation or if the trench bottom becomes soft due to the inflow of surface water or trapped water, a layer of geotextile filter fabric and a minimum of six (6) inches of crushed stone shall be placed on the bearing soil to provide a firm base for support of the pipe. Sump pits and pumps should be used to keep the excavations dry.

After the utility is installed, the trench must be backfilled with compacted fill. The fill shall consist of suitable on-site soil or imported sand. In the event that imported fill is required it shall conform to the gradation provided in "Installation of New Structural Fill" in Section 5.3. Controlled compacted fill shall be placed in one (1) foot loose layers and each layer shall be compacted to at least 92% of its Maximum Modified Dry Density (ASTM D1557). The backfill must be free of topsoil and debris.

6.2 Temporary Construction Excavations and Excavation Protection

Temporary construction excavations should be conducted in accordance with the most recent OSHA guidelines or applicable federal, state or local codes. A qualified person should evaluate the excavations at the time of construction to determine the appropriate soil type and allowable slope configuration. Based on the boring data, we believe the site soils and rock would have the following classifications as defined by the OSHA guidelines.

Soil/ Rock Type	Possible Classification	Maximum Slope or Bench
Existing Fill	Type "C"	1½H:1V
Virgin Soil	Type "B" or "C"	1H:1V or 1½H:1V
Weathered Rock/ Bedrock	Type "B"	1H:1V

Temporary support (i.e. trench boxes, sheeting and shoring, etc.) should be used for any excavation that cannot be sloped or benched in accordance with the applicable regulations, where necessary to protect adjacent utilities and structures, or where saturated soils or water seepage is encountered within the excavation.

A New York State licensed professional engineer must design all temporary and permanent support systems. The contractor will select the shoring type and submit design calculations for the proposed shoring method to Carlin-Simpson & Associates for review.

The soil adjacent to the temporary support system will exert horizontal pressure against the system. This pressure is based on the soil unit weight, coefficient of active earth pressure, and depth of the excavation. In addition, the surcharge loads from adjacent driveways, construction equipment, or stored materials near the excavation must be incorporated into the design of the support system, as applicable. The design parameters for temporary excavation support systems are listed in Table 6 below.

Table 6 – Temporary Excavation Support System Design Parameters

Description	Value
Moist Unit Weight (pcf)	130
Friction Angle (ϕ, deg)	30
Cohesion (c, psf)	0
Active Earth Pressure Coefficient (k_a)	0.33
Equivalent Fluid Pressure (pcf)	43.0
Passive Earth Pressure Coefficient (k_p)	3.0

6.3 Suitability of the In-Situ Soils for Use as Compacted Fill

The suitability of each soil stratum for use as compacted fill is discussed below.

Stratum 1A Topsoil
Topsoil is not suitable for use as compacted fill. During construction, it shall be stripped from the construction area. The topsoil may be reused in non-structural, non-sloped landscape areas or hauled offsite.

Stratum 1B Concrete
Concrete is not suitable for use as compacted fill. During construction, it shall be removed from the construction area.

Stratum 2 Existing Fill
The existing fill generally consists of brown, gray coarse to fine SAND, little (to some) Silt, varying amounts of coarse to fine Gravel. Debris consisting of wood was encountered in this stratum. In addition, many cobbles and boulders were noted in the existing fill stratum. This stratum has a high percentage of silt. This stratum will be very moisture sensitive. The existing fill is suitable for reuse as structural fill provided that it remains relatively dry for optimum compaction and any debris has been removed prior to its reuse.

Stratum 3 Silty Sand [USCS: SM]
The silty sand consists of brown or gray coarse to fine SAND, little (to some) Silt, trace (to some) coarse to fine Gravel. This stratum is generally suitable for reuse as compacted fill, as long as it remains relatively dry for optimum compaction. Note that some of this stratum is located below the groundwater table. Soil located below the groundwater table will be completely saturated and unsuitable for immediate reuse. Extensive drying will need to be performed to use soils located below the groundwater table.

Stratum 4/5 Weathered Bedrock and Bedrock
Where completely weathered rock or bedrock is excavated, it may be used as backfill material provided that the material is well graded and has been approved prior to use by Carlin-Simpson & Associates or qualified geotechnical engineering firm.

All rock fill must be well blended with smaller rock fragments and/or soil. The maximum particle size for rock placed as fill in the building area shall be three (3) inches in diameter. In other areas of the site, the maximum particle size shall be six (6) inches in diameter. The excavated rock will likely need to be processed through a crusher to provide suitable fill material.

The boring observations indicate that the on-site soils contain a varying percentage of silt (10% to 40%). The moderate to high silt content soils, particularly the existing fill, will be moisture sensitive. If the soil becomes too wet, it will be difficult to achieve adequate compaction. Note that some of the existing fill stratum is below the water table. Soil located below the water table will be completely saturated and unable for immediate reuse.

Proper moisture conditioning of the soil will be required. New compacted fill should be within 2% (+/-) of its optimum moisture content at the time of placement. In the event that the

on-site material is too wet at the time of placement and cannot be adequately compacted, the soil should be aerated and allowed to dry or the material removed and a drier cleaner fill material used. In the event that the on-site material is too dry at the time of placement and cannot be adequately compacted, water may be needed to increase the soil moisture content for proper compaction.

The minimum compaction requirements for the various areas of the site are summarized in Table 7 below.

Table 7 - Minimum Compaction Requirements

Area	Maximum Modified Dry Density (ASTM D-1557)
Building (below foundations)	95%
Building Slab (above foundations)	92%
Exterior Slabs and Sidewalks	92%
Utility Trenches	92%
Landscape Areas – Non-Sloped	90%

7.0 GENERAL

The findings, conclusions and recommendations presented in this report represent our professional opinions concerning subsurface conditions at the site. The opinions presented are relative to the dates of our sitework and should not be relied on to represent conditions at later dates or at locations not explored. The opinions included herein are based on information provided to us, the data obtained at specific locations during the study and our past experience. If additional information becomes available that might impact our geotechnical opinions, it will be necessary for Carlin-Simpson & Associates to review the information, reassess the potential concerns, and re-evaluate our conclusions and recommendations.

Regardless of the thoroughness of a geotechnical exploration, there is the possibility that conditions between borings and test pits will differ from those encountered at specific boring or test pit locations, that conditions are not as anticipated by the designers and/or the contractors, or that either natural events or the construction process have altered the subsurface conditions. These variations are an inherent risk associated with subsurface conditions in this region and the approximate methods used to obtain the data. These variations may not be apparent until construction.

The professional opinions presented in this geotechnical report are not final. Field observations and floor slab installation monitoring by the geotechnical engineer, as well as soil density testing and other quality assurance functions associated with site earthwork and floor slab construction, are an extension of this report. Therefore, a qualified geotechnical engineer should be retained by the Owner to observe all earthwork, foundation, and floor slab construction, to document that the conditions anticipated in this study actually exist, and to finalize or amend our conclusions and recommendations. Carlin-Simpson & Associates is not

responsible for or liable for the conclusions and recommendations presented in this report if Carlin-Simpson & Associates does not perform the observation and testing services.

Therefore, in order to preserve continuity in this project, the Owner must retain the services of a qualified geotechnical engineer to provide full time geotechnical related monitoring and testing during construction. At a minimum, this shall include the observation and testing of the following: 1) the removal of existing fill and unsuitable soil, where required; 2) the proofrolling of the subgrade soil prior to the placement of new compacted fill; 3) the placement and compaction of controlled fill; 4) the excavation for the new foundations; and 5) the preparation of the subgrade for the floor slab.

This report has been prepared in accordance with generally accepted geotechnical engineering practice. No other warranty is expressed or implied. The evaluations and recommendations presented in this report are based on the available project information, as well as on the results of the exploration. Carlin-Simpson & Associates should be given the opportunity to review the final drawings and site plans for this project to determine if changes to the recommendations outlined in this report are needed. Should the nature of the project change, these recommendations should be re-evaluated.

This report is provided for the exclusive use of H2M Architects + Engineers and the project specific design team and may not be used or relied upon in connection with other projects or by other third parties. Carlin-Simpson & Associates disclaims liability for any such third party use or reliance without express written permission. Use of this report or the findings, conclusions or recommendations by others will be at the sole risk of the user. Carlin-Simpson & Associates is not responsible or liable for the interpretation by others of the data in this report, nor their conclusions, recommendations or opinions.

If the conditions encountered during construction vary significantly from those stated in this report, this office should be notified immediately so that additional recommendations can be made.

Thank you for allowing us to assist you with this project. Should you have any questions or comments, please contact this office.

Very truly yours,
CARLIN-SIMPSON & ASSOCIATES, LLC

Catherine K Andersen

CATHERINE K. ANDERSEN, P.E.
Project Engineer

ROBERT B. SIMPSON, P.E.
Principal

File No. 24-26A



CARLIN-SIMPSON & ASSOCIATES Sayreville, NJ	TEST BORING LOG	BORING NUMBER SB-1
Project: Prop. Additions to Harrison High School, 255 Union Ave, Harrison NY		**SHEET NO.:** 1 of 1
Client: H2M Architects + Engineers		**JOB NUMBER:** 24-26A
Drilling Contractor: Environmental Technical Drilling, Inc		**ELEVATION:** -

GROUNDWATER					CASING	SAMPLE	CORE	TUBE	**DATUM:** -
DATE	TIME	DEPTH	CASING	TYPE	HSA	SS			**START DATE:** 25/Mar/24
25/Mar/24	-	6'0"	HSA	DIA.	2 1/4"	1 3/8"			**FINISH DATE:** 25/Mar/24
				WGHT		140#			**DRILLER:** S Pearce
				FALL		30"			**INSPECTOR:** KWA

Depth (ft.)	Casing Blows per Foot	Sample Number	Blows on Sample Spoon per 6"	Sym	IDENTIFICATION	REMARKS
			3			
1			4		**Topsoil** 0'8"	
		S-1	5		FILL (Br cf S, s $, t cf G)	Rec = 17"
2			5			moist
			6			
3		**S-2**	10		FILL (Gr, br cf S, l (+) $, l (-) cf G, w/cobbles)	Rec = 20"
			16		**FILL (Brown coarse to fine SAND,**	moist
4			33		**some Silt, trace coarse to fine Gravel**	
			14		**with cobbles and boulders)**	
5		**S-3**	18		FILL (same)	Rec = 15"
			8			moist
6			6			spoon tip wet
			5			
7		**S-4**	2		FILL (Br cf S, l (+) $, a cf G)	Rec = 5"
			4			wet
8			3		8'0"	
			30/2"		**Schist, Completely Weathered** 8'2"	Refusal at 8'2"
9					**End of Boring @ 8'2"**	on probable harder bedrock
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						

CARLIN-SIMPSON & ASSOCIATES Sayreville, NJ	TEST BORING LOG	BORING NUMBER SB-2
Project: Prop. Additions to Harrison High School, 255 Union Ave, Harrison NY		**SHEET NO.:** 1 of 1
Client: H2M Architects + Engineers		**JOB NUMBER:** 24-26A
Drilling Contractor: Environmental Technical Drilling, Inc		**ELEVATION:** -
GROUNDWATER		**DATUM:** -

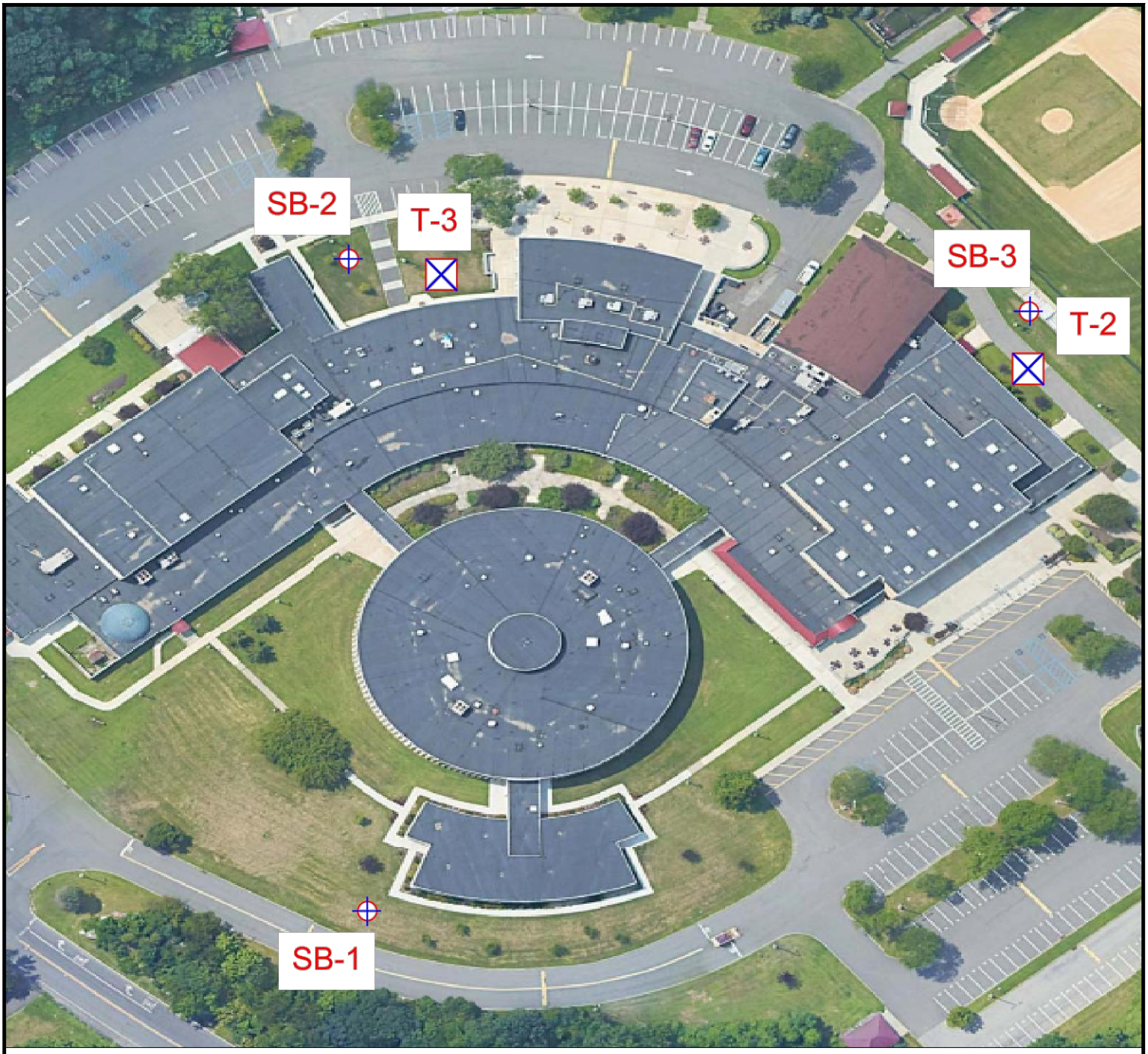
DATE	TIME	DEPTH	CASING		CASING	SAMPLE	CORE	TUBE	
				TYPE	HSA	SS			**START DATE:** 25/Mar/24
25/Mar/24	1030	5'3"	None	DIA.	2 1/4"	1 3/8"			**FINISH DATE:** 25/Mar/24
				WGHT		140#			**DRILLER:** S Pearce
				FALL		30"			**INSPECTOR:** KWA

Depth (ft.)	Casing Blows per Foot	Sample Number	Blows on Sample Spoon per 6"	Sym	IDENTIFICATION		REMARKS
			2				
1			6		**Topsoil**	0'7"	
		S-1	20		**FILL (Brown coarse to fine SAND, little**		Rec = 18"
2			17		**Silt, little coarse to fine Gravel)**		moist
			18		FILL (Gr, br cf S, l $, s (+) cf G)		
3		S-2	12		FILL (same)		Rec = 14"
			30		**FILL (Gray, brown coarse to fine SAND,**		moist
4			11		**little Silt, some (+) coarse to fine Gravel)**		
			3				
5		S-3	3		FILL (same)		Rec = 3"
			2			5'6"	wet
6			31				
					Gray Schist; weathered		
7							
		S-4	50/2"		Gr Schist; weathered	7'2"	Rec = 1"
8					**End of Boring @ 7'2"**		wet
							Refusal @ 7'2"
9							probable bedrock
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							

CARLIN-SIMPSON & ASSOCIATES Sayreville, NJ	TEST BORING LOG	BORING NUMBER SB-3
Project: Prop. Additions to Harrison High School, 255 Union Ave, Harrison NY		**SHEET NO.:** 1 of 1
Client: H2M Architects + Engineers		**JOB NUMBER:** 24-26A
Drilling Contractor: Environmental Technical Drilling, Inc		**ELEVATION:** -

GROUNDWATER					CASING	SAMPLE	CORE	TUBE	DATUM: -
DATE	TIME	DEPTH	CASING	TYPE	HSA	SS			START DATE: 27/Mar/24
27/Mar/24	1000	5'3"	None	DIA.	3 1/4"	1 3/8"			FINISH DATE: 27/Mar/24
				WGHT		140#			DRILLER: B Tolbert
				FALL		30"			INSPECTOR: KWA

Depth (ft.)	Casing Blows per Foot	Sample Number	Blows on Sample Spoon per 6"	Sym	IDENTIFICATION	REMARKS
			3		**Topsoil** 0'6"	
1		S-1	10		FILL (Br, gr cf S, s (-) $, l cf G)	Rec = 18"
			11			moist
2			17			
			8			
3		S-2	19		FILL (same)	Rec = 17"
			19		**FILL (Brown, gray coarse to fine SAND,**	moist
4			16		**some (-) Silt, little coarse to fine Gravel**	
			14		**with wood)**	
5		S-3	14		FILL (same, wood in spoon tip)	Rec = 17"
			18			moist
6			11		6'0"	
			4		**Gray, brown coarse to fine SAND,**	
7		S-4	5		**some (+) Silt, with trace roots [SM]** 7'0"	Rec = 16"
			5		Br cf S, s (+) $, t (-) f G	wet
8			11		**Brown coarse to fine SAND, some (+) Silt,**	
			14		**trace (-) fine Gravel**	
9		S-5	9		**[USCS: SM]**	Rec = 17"
			14		Gr, br cf S, s (-) $, s mf G, w/weathered Schist	wet
10			26		10'0"	
		S-6	50/2"		**Schist Completely Weathered** 10'2"	Refusal on spoon 10'2"
11					**End of Boring @ 10'2"**	Refusal on auger 10'4"
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						



GENERAL NOTES:

1. GENERAL LAYOUT WAS OBTAINED FROM A DRAWING PROVIDED BY H2M ARCHITECTS + ENGINEERS.
2. BORING AND TEST PIT LOCATIONS WERE LAID OUT IN THE FIELD BY CARLIN-SIMPSON & ASSOCIATES (CSA).
3. THE BORINGS WERE PERFORMED BY ENVIRONMENTAL TECHNICAL DRILLING INC. AND THE TEST PITS WERE PERFORMED BY TRAFICANTE CONTRACTING. BOTH THE BORINGS AND TEST PITS WERE IN MARCH 2024, UNDER THE FULL TIME INSPECTION OF CSA.
4. LOCATIONS ARE APPROXIMATE.

LEGEND:

- BORING LOCATION

- TEST PIT LOCATION

ROBERT B. SIMPSON, P.E.
PROFESSIONAL ENGINEER

BORING & TEST PIT LOCATION PLAN

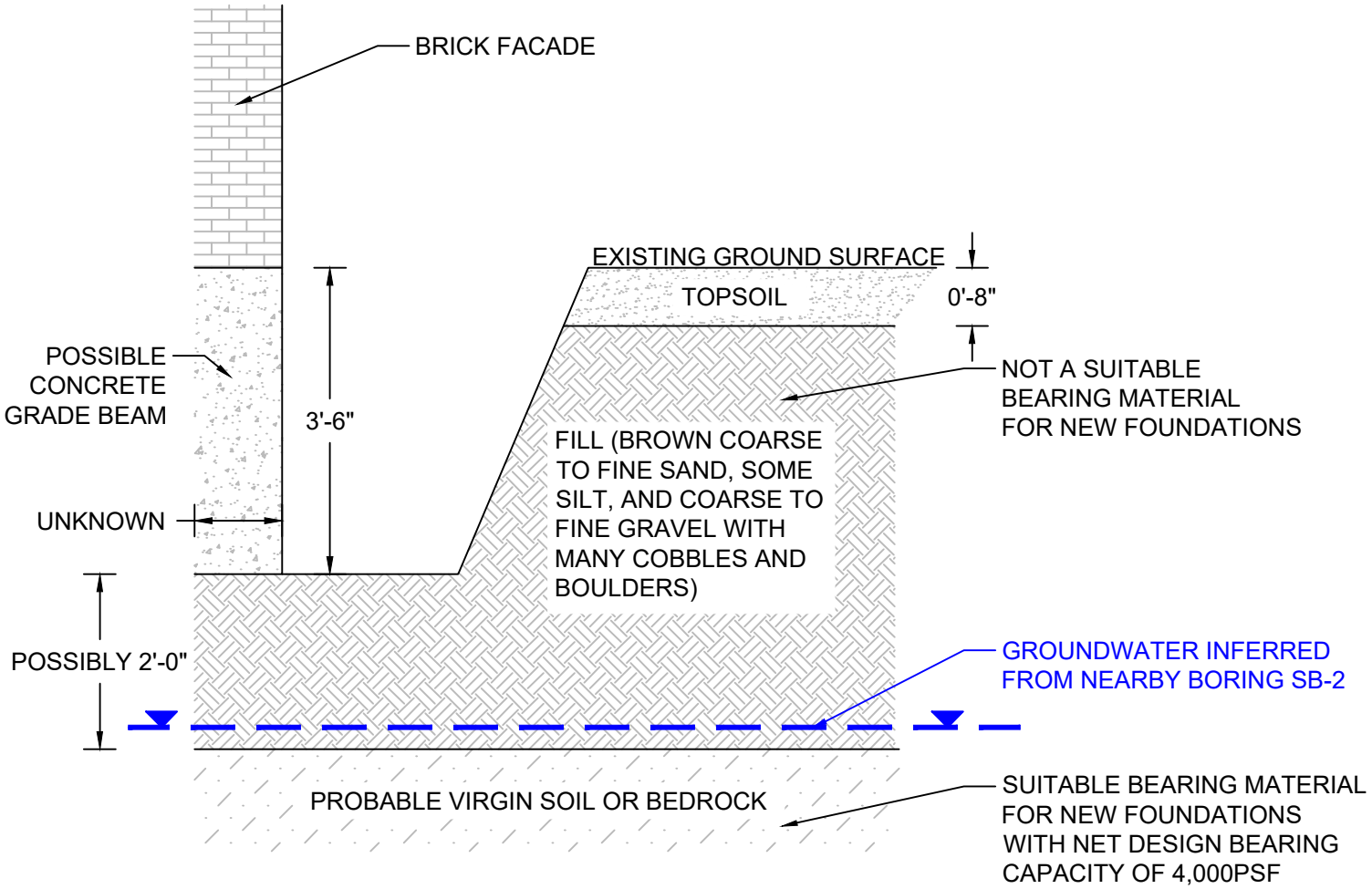
PROPOSED ADDITIONS
HARRISON HIGH SCHOOL
255 UNION AVENUE
HARRISON, NEW YORK

DRAWN: CKA	SCALE: NTS
CHECKED: RBS	DATE: 04.17.2024
PROJECT NO.: 24-26A	DWG NO.: FIG -1
APPROVED:	

CARLIN-SIMPSON AND ASSOCIATES, LLC
61 Main Street
Sayreville, NJ 08872

Consulting Geotechnical and Environmental Engineers

TEST PIT (T-2)



ROBERT B. SIMPSON, P.E.
PROFESSIONAL ENGINEER

TEST PIT (T-2) SKETCH

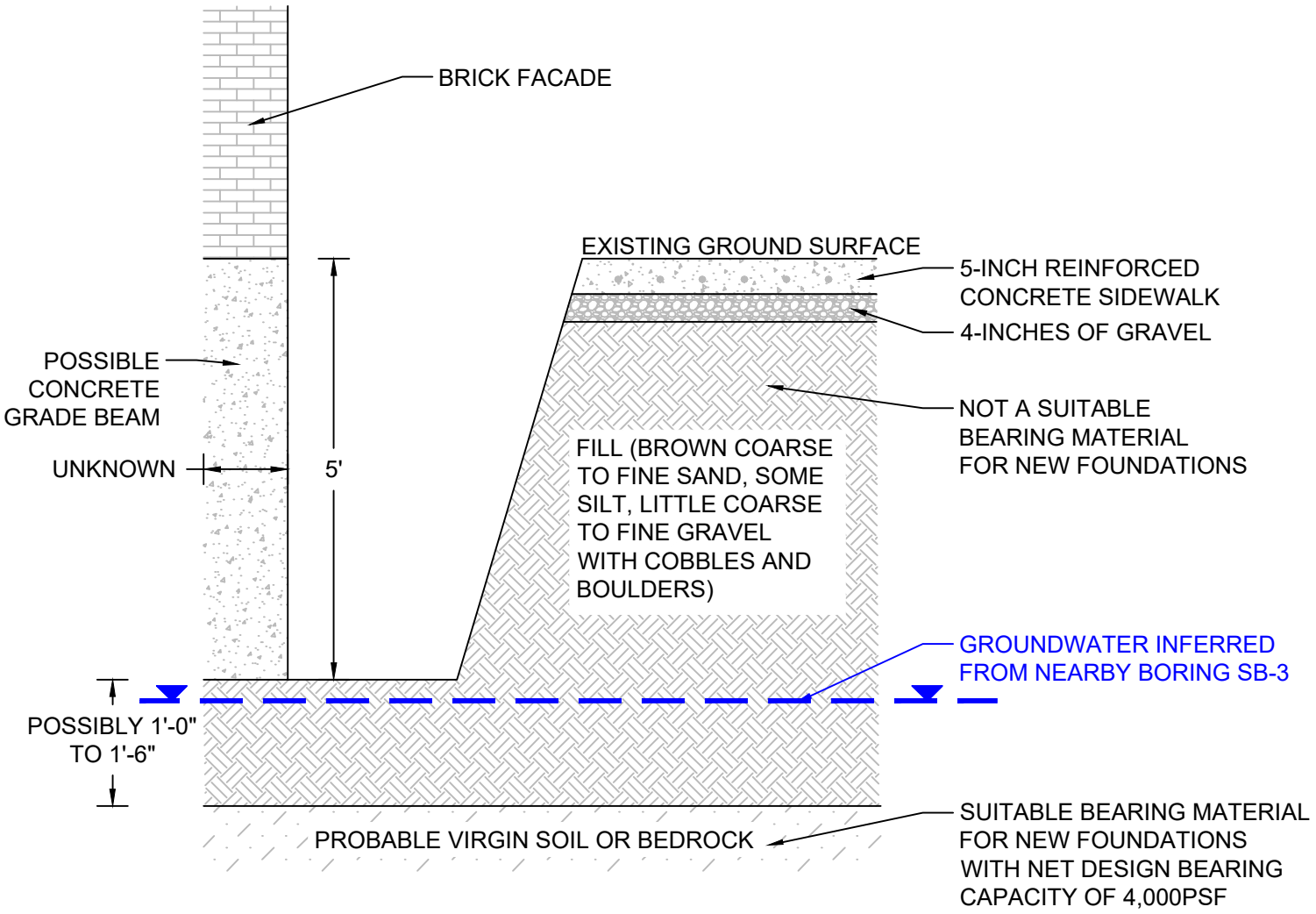
PROPOSED ADDITIONS
HARRISON HIGH SCHOOL
255 UNION AVENUE
HARRISON, NEW YORK

DRAWN: CKA	SCALE: 1" = 3'
CHECKED: RBS	DATE: 04.17.2024
PROJECT NO.: 24-26A	DWG NO.: FIG - 2
APPROVED:	

CARLIN-SIMPSON AND ASSOCIATES, LLC
61 Main Street
Sayreville, NJ 08872

Consulting Geotechnical and Environmental Engineers

TEST PIT (T-3)



ROBERT B. SIMPSON, P.E.
PROFESSIONAL ENGINEER

TEST PIT (T-3) SKETCH

PROPOSED ADDITIONS
HARRISON HIGH SCHOOL
255 UNION AVENUE
HARRISON, NEW YORK

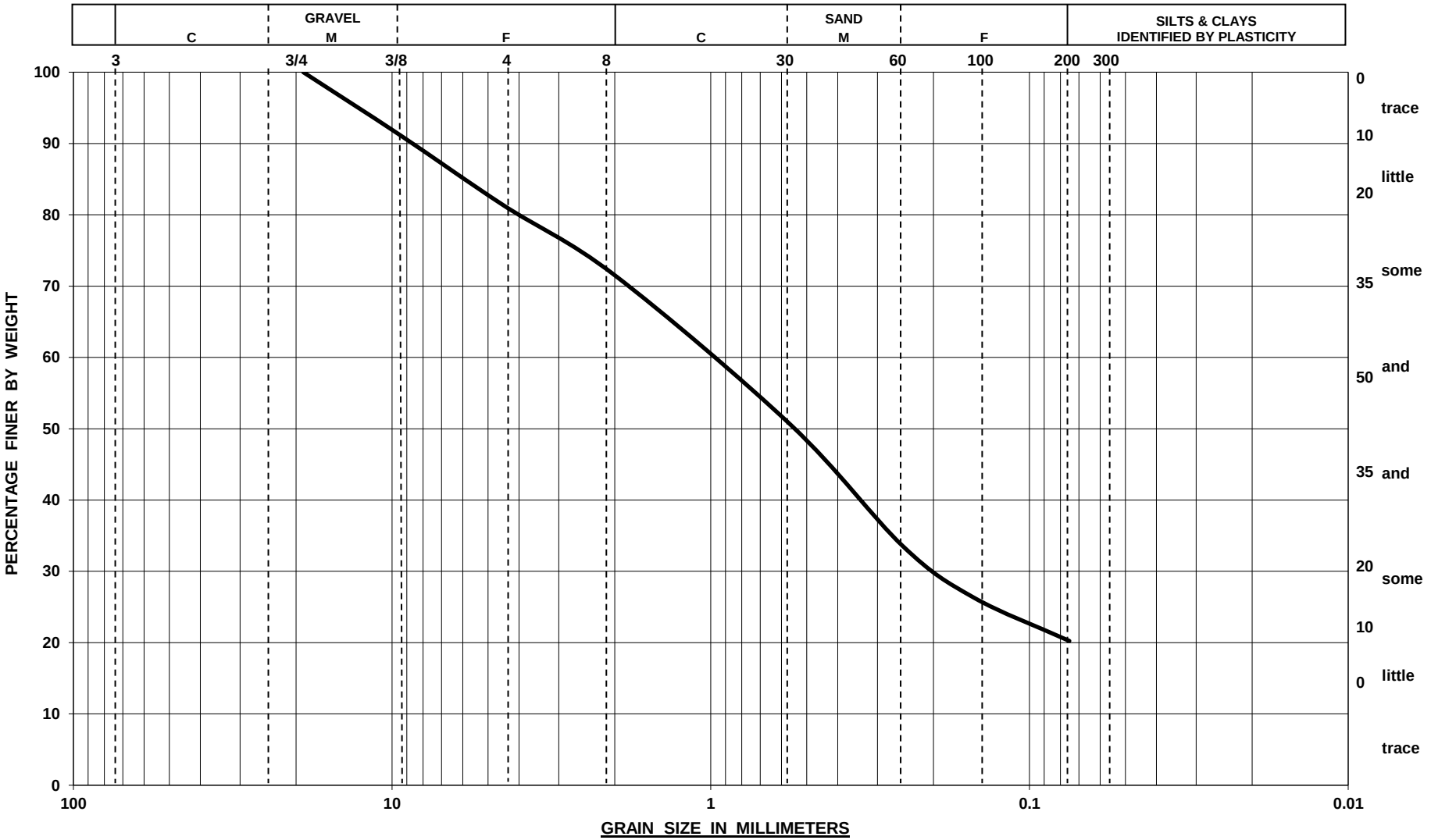
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CHECKED: RBS	DATE: 04.17.2024
PROJECT NO.: 24-26A	DWG NO.: FIG - 3
APPROVED:	

CARLIN-SIMPSON AND ASSOCIATES, LLC
61 Main Street
Sayreville, NJ 08872

Consulting Geotechnical and Environmental Engineers

CARLIN-SIMPSON & ASSOCIATES, LLC
SAYREVILLE, NJ 08872

SIEVE ANALYSIS



SYMBOL	BORING	SAMPLE	DEPTH	DESCRIPTION	NAT MC
———	B-3	S-5	8'-10'	Gray, brown coarse to fine SAND, some(-) Silt, some medium to fine Gravel [USCS: SM]	9.5%

PROJECT Proposed Additions, Harrison High School, 255 Union Ave, Harrison, NY **BY** NJA **DATE** 3-Apr-24 **JOB NO** 24-26A

PART 1 - GENERAL

1.01 BRIEF PURPOSE OF PROJECT / GENERAL

A. The purpose of the project is to construct a brand new fitness center building addition with new locker rooms, toilets, offices, fitness room and a multi-purpose space.

B. This Section provides an abbreviated summary of the work for the Construction Contracts associated with the Owner's program to construct the project.

C. In the event that any of the provisions in the technical specifications conflicts with the general conditions, the provision more favorable to the owner, as determined by the owner in its sole discretion, shall govern.

1.02 NOMENCLATURE

A. Where the terms "Engineer/Architect", "Architect/Engineer", "Engineer", or "Architect" are used throughout these Contract Documents, they shall mean the firm of H2M architects + engineers as may be abbreviated by H2M or H2M Group.

B. The General Construction Contractor may be referred to as the "General Contractor", "Prime General Contractor", "Contract G Contractor" or similar wording. The lack of word capitalization shall be incidental. This Construction Contract shall be known as Contract G.

C. The Electrical Construction Contractor may be referred to as the "Electrical Contractor", "Prime Electrical Contractor", "Contract E Contractor" or similar wording. The lack of word capitalization shall be incidental. This Construction Contract shall be known as Contract E.

D. The Heating, Ventilating & Air Conditioning Construction Contractor may be referred to as the "HVAC Contractor", "Prime HVAC Contractor", "Contract H Contractor" or similar wording. The lack of word capitalization shall be incidental. This Construction Contract shall be known as Contract H.

E. The Plumbing Construction Contractor may be referred to as the "Plumbing Contractor", "Prime Plumbing Contractor", "Contract P Contractor" or similar wording. The lack of word capitalization shall be incidental. This Construction Contract shall be known as Contract P.

F. Where the terms "Owner" or "Owner's Construction Representative" are used, they will be defined as a person selected by the Owner, or the actual Owner, XYZ Corporation.

1.03 ABBREVIATED SUMMARY OF CONTRACT G WORK

A. Furnish all labor, equipment, materials, tools, means, methods, and incidentals necessary to complete the Work as required by the Contract Documents for this Construction Contract. Each contractor shall coordinate, through the Owner/Architect/Engineer, the work of their contract with the work by others.

B. This following abbreviated summary is provided in order to briefly describe the work covered by the Contract Documents for this Construction Contract. It is not all inclusive of the work under the Contract.

C. The work includes, but is not limited to, the following:

1. Portion of existing building to be completely demolished in its entirety, including but not limited to the removal of all foundations/footings, floor slabs, interior partitions, exterior walls, ceilings, fixtures, finishes, equipment, building systems, doors, windows, roof system, etc. following complet demolition of the building area, the contractor shall prepare site for proposed work.
2. Tree removal, site clearing, grubbing, sheeting, bracing, excavation, soil erosion protection, slope protection, earth movement, subgrade preparation, removal of excess and/or unsuitable excavated material, dewatering, and import of suitable material, as necessary to install and construct all the work defined within the Contract Documents.
3. Demolition and removals as shown.
4. Temporary support facilities such as temporary roads, and paved areas; snow and ice removal; temporary site fencing.
5. Security and protection facilities such as environmental protection; stormwater control; tree and plant protection; pest control; site enclosure fence; security enclosure and lock up; barricades; warning signs; temporary railings (if required); temporary egress; covered facilities; clearing and grubbing.
6. New elevator.
7. All trenching, excavation, removal of excess and/or unsuitable excavated material, sheeting reinforcement, import of suitable material, soil compaction and testing shall be provided by Contract 'G'. Each prime ('P', 'H', and 'E') shall be responsible to coordinate with contract 'G' and bed and set their underground ulitieis/piping/conduit/etc.
8. All backfill, compaction and testing associated with the preparation for the new floor slab shall be provided by Contract 'G'.
9. Construction of new building, including: all concrete footings/foundations/walls, concrete reinforcement, penetrations, structural steel, masonry, light-gauge, drywall, trusses, framing, roofing, windows, doors, louvers, grating, stairs, siding, finishes, etc.
10. Install finishes as scheduled.
11. Removals and renovations within existing building as shown on drawings.
12. Penetrations through existing walls and roofs as associated repair work as required for HVAC and Electrical work as shwon on drawings. Contractor shall maintain roof warranties.
13. Surface preparation and coating of structural steel, walls, and other items as noted.
14. Install epoxy floor coating system.
15. Site restoration including final grading and placement of topsoil and seeding.
16. New sidewalks and concrete curbing.
17. Project closeout submittals.

D. All other work shown and specified within the Contract Documents for Contract G.

1.04 ABBREVIATED SUMMARY OF CONTRACT E WORK

A. Furnish all labor, equipment, materials, tools, means, methods, and incidentals necessary to complete the Work as required by the Contract Documents for this Construction Contract. Each Contractor shall coordinate, through the Owner/Architect/Engineer, the work of their contract with the work by others.

B. This following abbreviated summary is provided in order to briefly describe the work covered by the Contract Documents for this Construction Contract. It is not all inclusive of the work under the Contract.

C. The work includes, but is not limited to, the following:

1. Provide, install, maintain, and repair, if necessary, temporary power and light throughout the site and to the Owner/Architect/Engineer's field office. Temporary power shall be provided at location(s) selected by the Architect/Engineer based on input by the General Contractor.
2. Main secondary feeders, power distribution, and instrumentation control wiring. Provide, mount, and install electrical conduit, wire, fittings, boxes, panels, and electrical accessories.
3. Setting of electrical sleeves and/or embedded conduit in all concrete construction. All conduit for new construction shall be embedded in concrete slabs, decks, or walls.
4. Electrical connections (final termination) to all equipment, control panels, ventilating equipment and electrical devices.
5. Startup participation for the various equipment and systems of the project and provide complete service to troubleshoot and assist manufacturer service representatives in obtaining a completely functional installation.
6. Removal of existing components as noted.
7. New secondary feeders, power distribution, and instrumentation control wiring. New electrical conduit, wire, fittings, boxes, panels, and electrical accessories.
8. New lighting fixtures, wiring and associated equipment.
9. All excavation, trenching, backfilling, and rough grading associated with the installation of pull-boxes, underground conduit, and wiring shall be by Contract 'G'. Contract 'E' is responsible to bed and set all undergroudn ulitieis/piping/conduit/etc. Final restoration by Contract G.
10. Final electrical terminations to all control panels, pumping equipment, blowers, HVAC equipment, etc.
11. Wiring connections to all electrical equipment (including equipment furnished by others).
12. Elevator controller disconnect switch; elevator controller, and elevator motor and disconnect switch.
13. New fire alarm devices, wiring, and associated equipment.
14. Testing, programming and adjusting of all electrical systems.
15. Startup participation for the various equipment and systems of the project. Provide complete service to troubleshoot and assist manufacturer service representatives in obtaining a completely functional installation. Provide systems and equipment training for Owner personnel.
16. Project closeout submittals.

D. All other work shown and specified in the Contract Documents for Contract E.

1.05 ABBREVIATED SUMMARY OF CONTRACT H WORK

A. Furnish all labor, equipment, materials, tools, means, methods, and incidentals necessary to complete the Work as required by the Contract Documents for this Construction Contract. Each contractor shall coordinate, through the Owner/Architect/Engineer, the work of their contract with the work by others.

B. This following abbreviated summary is provided in order to briefly describe the work covered by the Contract Documents for this Construction Contract. It is not all inclusive of the work under the Contract.

C. The work includes, but is not limited to, the following:

1. Startup participation for the various equipment and systems of the project and provide complete service to troubleshoot and assist manufacturer service representatives in obtaining a completely functional installation.
2. New electric unit heaters.
3. New exhaust fans, supports, and associated equipment.
4. New grilles, registers, duct work, supports and accessories.
5. Testing and balancing of systems.
6. Commissioning.
7. 5-year full maintenance extended warranty for all mechanical equipment including filters.
8. Project closeout submittals.

D. All other work shown and specified in the Contract Documents for Contract H.

1.06 ABBREVIATED SUMMARY OF CONTRACT P WORK

A. Furnish all labor, equipment, materials, tools, means, methods, and incidentals necessary to complete the Work as required by the Contract Documents for this Construction Contract. Each contractor shall coordinate, through the Owner/Architect/Engineer, the work of their contract with the work by others.

B. This following abbreviated summary is provided in order to briefly describe the work covered by the Contract Documents for this Construction Contract. It is not all inclusive of the work under the Contract.

C. The work includes, but is not limited to, the following:

1. Startup participation for the various equipment and systems of the project and provide complete service to troubleshoot and assist manufacturer service representatives in obtaining a completely functional installation.
2. Removal of existing buried piping (water main, blow off lines, drainage lines) as noted.
3. Removal of existing interior piping, valves, and mechanical equipment, as noted.
4. 'P' contractor shall be responsible to coordinate with contract 'G' for all excavation and trehcning associated with the removal and/or installation of new piping. 'P' Contractor shall be responsible to bed and set their underground utilities/piping/etc. See summary of work under Contract 'G' for full scope.
5. New penetration sleeves (as required), placement to be coordinated with Contract G.
6. New sump pumps, drainage piping, valves, and accessories.
7. New vent piping to be terminated above the roof.
8. New foor drains, drinking fountains and hose bibbs as indicated.
9. New cold and hot water for new plumbing fixtures to be tapped from existing main distribution.
10. New roof drains to connect to existing storm pipe distribution.
11. New plumbing fixtures and accessories as indicated on drawings.
12. Startup participation for the various equipment and systems of the project. Provide complete services to troubleshoot and assist manufacturer service representatives in obtaining a

completely functional installation. Provide systems and equipment training for Owner personnel.

13. Project closeout submittals.

D. All other work shown and specified in the Contract Documents for Contract P.

1.07 PARTIAL LISTING OF SPECIFIC CONTRACT REQUIREMENTS

A. The Contract Documents detail the work included in the Contract. Related requirements and conditions covered by the Contract Documents include, but are not limited to, the following:

1. The contractor shall adhere to all New York State Education Department requirements, including but not limited to NYCRR, Title 8, Chapter 2, Part 155.5 - Uniform Safety Standards for School Construction and Maintenance.

1.08 PARTIAL LISTING OF OVERALL CONTRACT REQUIREMENTS

A. The Contract Documents detail the work included in the Contract. Related requirements and conditions covered by the Contract Documents include, but is not limited to, the following:

1. Debris removal and daily and final cleaning up.
2. Site utilization and management so as not to disrupt the Owner’s ability to operate the existing facilities in a safe and efficient manner.
3. Product and equipment storage and handling requirements.
4. Site safety in accordance with all applicable federal, state, and local regulations.
5. Project submittals, testing services, , work plans, , schedules, , shop drawings, , closeout procedures and documents, , manuals, , as-built drawings, , and final commissioning, of the work shall be provided as required by the Contract.

1.09 OWNER SUPPLIED PRODUCTS AND UTILITIES

A. The Owner will not be supplying equipment, labor, or tools for the project.

1.10 EXISTING CONDITIONS

A. The Drawings show certain information that has been obtained by the Owner regarding various conditions that exist at the location of the project both below and at grade.

B. The Owner and the Architect/Engineer expressly disclaims all responsibility for the accuracy or completeness of the information given on the Drawings with regard to existing facilities.

C. In the case where the Contractor discovers an obstruction not indicated on the Drawings or not described via specification reference, then the Contractor shall immediately notify the Architect/Engineer of the obstructions’ existence.

D. The Architect/Engineer will determine if the obstruction is to be relocated or removed.

E. Compensation for this extra work will be paid for in accordance with the provisions in the Contract for "Extra Work".

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Site access and control of areas outside of site.

B. Contractor use of the premises.

C. Contractor storage, parking and deliveries.

D. Work hours, employee conduct and miscellaneous employee requirements.

1.02 SITE ACCESS AND CONTROL

A. Contractors shall use the designated entrance to the site as shown on the drawings. If no site entrance is designated, Contractors shall use an entrance designated by the Owner's Construction Representative.

1. The Owner may permit, solely at the Owner's discretion, the temporary use of another entrance for site access.
2. The Owner will only review requests made by the Contractor for an exception to the designated site entrance if made in writing at least 72 hours in advance of each of the times desired for use.

B. All contractors to maintain the entrance area clear of materials, vehicles and any other obstacle or debris. Failure to do so will result in a minimum back charge of $750 per occurrence.

C. The area around the site is a residential neighborhood. The Owner intends to be a good neighbor. Contractors shall not close any road for any period in time. The Contractors shall take whatever measures are necessary to not cause any inconvenience to the area's residents

D. All Contractors are responsible to employ methods to prevent construction materials and/or debris from leaving the site. All Contractors are responsible to routinely monitor the areas surrounding the site during the day as well as at the end of the work-day and to immediately clean up any area to its previous condition.

E. The Contractors shall employ methods to prevent the transmission of dirt from vehicles driving on exposed areas of the site from reaching the surrounding roadways. The Contractors will be responsible to immediately clean the roadway, should the measures being taken by the Contractors not satisfactorily control the transmission of any dirt to the roadway.

F. Any damages to areas outside the site, spills of soil, liquid, or any other material shall immediately be repaired, cleaned and restored to its previous condition.

G. The Contractors shall comply with all state and local requirements for allowable weight limits of vehicles on all roads.

H. The Owner reserves the right to back charge the Contractors for all costs associated with maintaining the grounds as well as maintaining areas outside the site, which may be disturbed by the Contractors should the Contractors fail to maintain or repair the aforementioned in a condition acceptable to the Owner.

1.03 CONTRACTOR USE OF THE PREMISES

A. Premises, for the purpose of this Contract, shall mean the site, buildings and other structures located within the property line or in any temporary or permanent construction easements identified on the plans.

B. The Contractors shall use and manage the premises and the associated construction activities as follows:

1. To not hinder the Owner's ability to operate their facilities.
2. To allow other Prime Contractors to install their work and complete their contractual obligations in the time period specified.
3. To allow for stockpiling of construction material and debris without any significant hardship, as defined by the Owner's Construction Representative, on the Owner or other contractors.
4. To allow for the stockpiling of excavated soil and imported fill, when called for, without any significant hardship, as defined by the Owner's Construction Representative, on the Owner or other contractors.
5. To allow utility companies to install their work.
6. To allow for the delivery of equipment and materials by independent trucking companies by leaving enough space for backing in and out of areas.
7. To allow for the safe, unimpeded travel way of the Owners vehicles, Owner's Construction Representative's vehicles, Architect/Engineer's vehicles, construction vehicles and heavy construction equipment about the entire site.

C. Contractors shall maintain the premises in a safe condition throughout the construction period. Compliance with OSHA regulations and site safety shall be the responsibility of the Contractor as it relates to work of the Contract. The posting of all applicable OSHA safety signs shall be the responsibility of the Contractors.

D. Contractors shall be responsible for protecting Owner's property. All existing buildings, structures, shrubs, trees, lawn fixtures, sculptures and misc. equipment shall be protected at all times. Any removals or relocation of said objects, if allowed shall be as directed by Owner's Construction Representative.

E. Contractors shall protect all of the physical structures, property and improvements upon the site from damage by their Work and shall immediately repair or replace damage caused by construction operations, employees or equipment employed by the Contractor. All labor, materials and equipment and outside contractors that are employed by the Owner to repair damage caused by the Contractor shall be billed to the Contractor directly or withheld from money due the Contractor for work already completed.

F. Immediately remove excess excavated material or relocate to areas on the site requiring placement of fill. Do not stockpile excess material on the site.

G. The construction site space is limited and it shall be the General Contractor's responsibility to manage the site during the entire construction period with input from all concerned parties as to meeting their needs. Equal consideration of the needs of others with that of the Contractor's shall be provided as judged by the Owner.

H. Due to the limited site area available for construction, staging areas shall be relocated several times during the various stages of construction. Additional compensation for relocating staging areas, equipment and material storage, and trailers are not to be considered an extra cost to the Contractor as this is an anticipated expense that shall be considered at the time of the bid.

I. Contractors are responsible for cleaning up their own materials and debris. Failure to maintain a clean work site daily, will result in other performing the work and Contractors being back charged for the cleaning cost plus construction administration fees.

J. Use of the existing building facilities during construction is prohibited including but not limited to: toilet rooms, telephone and water fountains. Contractors shall be fined ($250) per occurrence if their employee (or subcontractor's employee) is observed disregarding these rules.

K. Should it become necessary to access the existing building during construction hours for measurements or other non-disruptive work, the contractor shall be escorted by an Owner's Construction Representative.

L. Do not discard or dispose of any waste on-site.

M. Open fires will not be permitted on the site.

N. The Sitework Contractor shall employ erosion control measures to protect wetlands located adjacent to the work where shown on the Drawings and as required by regulatory agencies.

O. Install erosion control measures as indicated in the Contract. The Contractor shall confine stormwater runoff to the site.

1.04 CONTRACTOR STORAGE, PARKING AND DELIVERIES

A. Contractors must provide exterior storage containers when required. Final location of storage container shall be determined by the Owner.

B. Do not unreasonably encumber the premises with materials and equipment. Do not store material in existing buildings. Store all equipment and materials to allow the Owner's employees to operate and conduct their business safely.

C. Confine premise storage areas to locations designated by the Owner. Immediately repair or replace damaged facilities to the satisfaction of the Owner and to a condition that existed before the damage occurred as determined by preconstruction photographs, or if photographs are unavailable, to that deemed by the Owner.

D. No materials storage will be permitted within the buildings at any time during construction.

E. Storage of chemicals and paint materials shall be outside the existing or new structures and shall follow manufacturer's storage/handling guidelines.

F. Compressed gas containers shall be properly stored and secured per OSHA, to the satisfaction of the Owner. Failure to do so will result in a $250 back charge, per occurrence.

G. Contractors shall provide minimum of 48 hours advance written notice to the Owner's Construction Representative for deliveries of materials, site visits by inspectors, manufacturer's

representatives or any other occasion that impacts the use of the site. Contractors shall be responsible for any costs that are incurred by the owner, for failure to meet previously agreed upon appointments or work schedules.

H. Deliveries sent to the Owner will not be signed for or unloaded by the Owner. They will be directed to the construction site and if no employee is on site, the delivery will be rejected, at the contractor's expense.

I. Night deliveries of equipment (past the designated quitting time) will not be permitted. Do not schedule trucking companies to deliver equipment or wait for the job site to open. Delivery trucks shall not obstruct the site entrance, shall not sit within the neighborhood causing an obstruction or perceived nuisance, nor be left idling on or off the site for any period of time.

J. Parking shall be in the designated areas of the site only. All automotive type vehicles are to be locked when parked or unattended to prevent unauthorized use. Do not leave vehicles or equipment unattended with the motor running or the ignition key in place. Any vehicles or trucks in non-designated areas may be towed at contractor's expense.

1.05 WORK HOURS, EMPLOYEE CONDUCT AND MISCELLANEOUS EMPLOYEE REQUIREMENTS

A. The Contractors will be permitted to schedule working days and hours as specified in the General Terms and Conditions, if no times are specified therein then the work hours shall be Monday - Friday 8:00 am - 4:00 pm.

B. Employees are to act in a professional manner. Any employee using inappropriate language or who is disruptive to the work environment will be banned from the site.

C. Proper work attire is required. Shirts are to be worn at all times and no short pants are permitted.

D. Comply with the Owner's Identification and Personal Protection Policies. A copy of the current policy will be distributed at the initial job meeting.

E. Employees shall not converse with local residents or Owner's employees.

F. Any employee found under the influence of any drug or alcohol will be banned from the site.

G. The following items are not allowed on the Site or the Owner's premises. Any person observed to bear any of the following items will be immediately removed from the site.

1. Firearms, ammunition, weapons, and dangerous instruments (other than tools required for the work).
2. Alcoholic beverages or illegal controlled substances.
3. Cameras (except with written permission from the Owner).

H. Smoking is not permitted withing the building except for outdoors at least 100 feet from any window, louver, or door. Comply with the Owner's policies relating to smoking at the Site.

I. The Contractors shall schedule working days and hours as specified. The contractor shall pay all excess costs for working beyond the times specified. This includes the cost of the owner's employees to keep the building/site open and/or the cost of the additional services for the construction manager.

1.06 UNIFORM SAFETY STANDARDS

A. Section 155.5 Uniform Safety Standards for School Construction and Maintenance Projects

Disclaimer: These Rules of the Regents and Regulations of the Commissioner of Education ("regulations") are unofficial, and are presented for general informational purposes as a public service. Although reasonable efforts have been made to ensure that these regulations are current, complete and accurate, the State Education Department does not warrant or represent that they are current, complete and accurate. These regulations are subject to change on a regular basis. Readers are advised to consult Title 8 of the Official Compilation of Codes, Rules and Regulations of the State of New York (8 NYCRR), published by the Department of State, and the State Register <http://www.dos.state.ny.us/info/register.htm> for the official exposition of the text of these regulations, as well as for amendments and any subsequent changes or revisions thereto.

1. Monitoring of construction and maintenance activities.
   a. The occupied portion of any school building shall always comply with the minimum requirements necessary to maintain a certificate of occupancy and shall be monitored during construction or maintenance activities for safety violations by school district personnel. It is the responsibility of the board of education or board of cooperative educational services to assure that these standards are continuously maintained when the building or any portion thereof is occupied.
   b. Investigation and disposition of complaints relating to health and safety received as a result of construction and maintenance activities.
      1) Boards of education and boards of cooperative educational services shall follow procedures established under section 155.4(d)(7) of this Part.
   c. Pre-construction testing and planning for construction projects.
      1) Boards of education and boards of cooperative educational services shall assure that proper planning is made for safety of building occupants during construction. For all construction projects for which bids are issued on or after September 30, 1999, such boards shall assure that safety is addressed in the bid specifications and contract documents before contract documents are advertised for bid. All school areas to be disturbed during renovation or demolition shall be tested for lead and asbestos. Appropriate procedures to protect the health of building occupants shall be included in the final construction documents for bidding.
      2) Boards of education and boards of cooperative educational services shall establish procedures for involvement of the health and safety committee to monitor safety during school construction projects. The health and safety committees in school districts other than in cities with one million inhabitants or more shall be expanded during construction projects to include the project architect, construction manager, and the contractors. Such committee shall meet periodically to review issues and address complaints related to health and safety resulting from the construction project. In the case of a city school district in a city of one million inhabitants or more, the board of education shall submit procedures for protecting health and safety during construction to the commissioner for approval. Such procedures shall outline methods for compliance with this section.
      3) The district emergency management plan shall be updated to reflect any changes necessary to accommodate the construction process, including an updated emergency exit plan indicating temporary exits required due to construction.

Provisions shall be made for the emergency evacuation and relocation or release of students and staff in the event of a construction incident.

4) Fire drills shall be held to familiarize students and staff with temporary exits and revised emergency procedures whenever such temporary exits and revised emergency procedures are required.

d. Pre-construction notification of construction projects.
   1) The board of education or board of cooperative educational services shall establish procedures for notification of parents, staff and the community in advance of a construction project of $10,000 or more to be conducted in a school building while the building is occupied. Such procedures shall provide notice at least two months prior to the date on which construction is scheduled to begin, provided that in the case of emergency construction projects, such notice shall be provided as far in advance of the start of construction as is practicable. Such notice shall include information on the district's obligations under this section to provide a safe school environment during construction projects. Such notice requirement may be met by publication in district newsletters, direct mailings, or holding a public hearing on the project to inform parents, students, school personnel and community members.
e. General safety and security standards for construction projects.
   1) All construction materials shall be stored in a safe and secure manner.
   2) Fences around construction supplies or debris shall be maintained.
   3) Gates shall always be locked unless a worker is in attendance to prevent unauthorized entry.
   4) During exterior renovation work, overhead protection shall be provided for any sidewalks or areas immediately beneath the work site or such areas shall be fenced off and provided with warning signs to prevent entry.
   5) Workers shall be required to wear photo identification badges at all times for identification and security purposes while working at occupied sites.
f. Separation of construction areas from occupied spaces.
   1) Construction areas which are under the control of a contractor and therefore not occupied by district staff or students shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the building. Periodic inspection and repairs of the containment barriers must be made to prevent exposure to dust or contaminants. Gypsum board must be used in exit ways or other areas that require fire rated separation. Heavy duty plastic sheeting may be used only for a vapor, fine dust or air infiltration barrier, and shall not be used to separate occupied spaces from construction areas.
   2) A specific stairwell and/or elevator should be assigned for construction worker use during work hours. In general, workers may not use corridors, stairs or elevators designated for students or school staff.
   3) Large amounts of debris must be removed by using enclosed chutes or a similar sealed system. There shall be no movement of debris through halls of occupied spaces of the building. No material shall be dropped or thrown outside the walls of the building.
   4) All occupied parts of the building affected by renovation activity shall be cleaned at the close of each workday. School buildings occupied during a construction project shall maintain required health, safety and educational capabilities at all times that classes are in session.

g. Maintaining exiting and ventilation during school construction projects.
   1) The following information shall be included in all plans and specifications for school building projects:
      (a) A plan detailing how exiting required by the applicable building code will be maintained during construction. The plan shall indicate temporary construction required to isolate construction equipment, materials, people, dust, fumes, odors, and noise during the construction period. Temporary construction details shall meet code-required fire ratings for separation and corridor enclosure. At a minimum, required exits, temporary stairs, ramps, exit signs, and door hardware shall be provided at all times.
      (b) A plan detailing how adequate ventilation will be maintained during construction. The plan shall indicate ductwork which must be rerouted, disconnected, or capped in order to prevent contaminants from the construction area from entering the occupied areas of the building. The plan shall also indicate how required ventilation to occupied spaces affected by construction will be maintained during the project.

h. Fire and hazard prevention.
   1) Areas of buildings under construction that are to remain occupied shall maintain a certificate of occupancy. In addition, the following shall be strictly enforced:
      (a) No smoking is allowed on public school property, including construction areas.
      (b) During construction daily inspections of district occupied areas shall be conducted by school district personnel to assure that construction materials, equipment or debris not block fire exits or emergency egress windows.
      (c) Proper operation of fire extinguishers, fire alarm, and smoke/fire detection systems shall be maintained throughout the project.

i. Noise abatement during construction and maintenance activities.
   1) Construction and maintenance operations shall not produce noise in excess of 60 dba in occupied spaces or shall be scheduled for times when the building or affected building spaces are not occupied or acoustical abatement measures shall be taken. Noise level measurements (dba) shall be taken with a type 2 sound level meter in the occupied space in a location closest to the source of the noise. Complaints regarding excessive noise shall be addressed through the health and safety committee. The district should anticipate those times when construction noise is unacceptable and incorporate “no work” periods into the bid specifications.

j. Control of chemical fumes, gases, and other contaminants during construction and maintenance projects.
   1) The bid specifications and construction contracts for each construction project shall indicate how and where welding, gasoline engine, roofing, paving, painting or other fumes will be exhausted. Care must be taken to assure fresh air intakes do not draw in such fumes.
   2) The bid specifications shall require schedules of work on construction and maintenance projects which include time for off-gassing of volatile organic compounds introduced during construction before occupancy is allowed. Specific attention is warranted for activities including glues, paint, furniture, carpeting, wall coverings, and drapery. Manufacturers shall be contacted to obtain information regarding appropriate temperatures and times needed to cure or ventilate the product during use and before safe occupancy of a space can be assured. Building materials or furnishings which off-gas chemical fumes, gases, or other

contaminants shall be aired out in a well ventilated heated warehouse before it is brought to the project for installation or the manufacturer's recommended off-gassing periods must be scheduled between installation and use of the space. If the work will generate toxic gases that cannot be contained in an isolated area, the work must be done when school classes and programs are not in session. The building must be properly ventilated and the material must be given proper time to cure or off-gas before re-occupancy.

3) Manufacturer's material safety data sheets (MSDS) shall be maintained at the site for all products used in the project. MSDS must be provided to anyone who requests them. MSDS indicate chemicals used in the product, product toxicity, typical side effects of exposure to the product and safe procedures for use of the product.

k. Asbestos abatement protocols.
   1) All asbestos abatement projects shall comply with all applicable Federal and State laws including but not limited to the New York State Department of Labor industrial code rule 56 (12 NYCRR 56), and the Federal Asbestos Hazard Emergency Response Act (AHERA), 40 CFR part 763 (Code of Federal Regulations, 1998 Edition, Superintendent of Public Documents, U.S. Government Printing Office, Washington, DC 20402; 1998; available at the Office of Facilities Planning, Education Building Annex, Room 1060, State Education Department, Albany, NY 12234). Large and small asbestos projects as defined by 12 NYCRR 56 shall not be performed while the building is occupied. Minor asbestos projects defined by 12 NYCRR 56 as an asbestos project involving the removal, disturbance, repair, encapsulation, enclosure or handling of 10 square feet or less of asbestos or asbestos material, or 25 linear feet or less of asbestos or asbestos material may be performed in unoccupied areas of an occupied building in accordance with the above referenced regulations.

l. Lead paint.
   1) Any construction or maintenance operations which will disturb lead based paint will require abatement of those areas pursuant to protocols detailed in the “Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing” (June 1995; U.S. Department of Housing and Urban Development, Washington, D.C. 20410; available at the Office of Facilities Planning, Education Building Annex, Room 1060, State Education Department, Albany, NY 12234). All areas scheduled for construction as well as areas of flaking and peeling paint shall be tested for the presence of lead and abated or encapsulated in accordance with the above noted guidelines.

m. Radon.
   1) Districts shall take responsibility to be aware of the geological potential for high levels of radon and to test and mitigate as appropriate. This information is available from the New York State Department of Health Radon Measurement Database.

n. Post construction inspection.
   1) The school district or board of cooperative educational services shall provide the opportunity for a walk-through inspection by the health and safety committee members to confirm that the area is ready to be reopened for use.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. SED Commissioner's Uniform Safety Standards - Section155.5

B. SED Commissioner's Uniform Safety Standards - Section 155.7-Health and safety in existing educational facilities

C. Contractor use of the premises.

1.02 SITE ACCESS AND CONTROL

A. Contractors shall use the designated entrance to the site as shown on the drawings. If no site entrance is designated, Contractors shall use an entrance designated by the Owner's Construction Representative.

1. The Owner may permit, solely at the Owner's discretion, the temporary use of another entrance for site access.
2. The Owner will only review requests made by the Contractor for an exception to the designated site entrance if made in writing at least 72 hours in advance of each of the times desired for use.

B. All contractors to maintain the entrance area clear of materials, vehicles and any other obstacle or debris. Failure to do so will result in a minimum back charge of $750 per occurrence.

C. The area around the site is a residential neighborhood. The Owner intends to be a good neighbor. Contractors shall not close any road for any period in time. The Contractors shall take whatever measures are necessary to not cause any inconvenience to the area's residents

D. All Contractors are responsible to employ methods to prevent construction materials and/or debris from leaving the site. All Contractors are responsible to routinely monitor the areas surrounding the site during the day as well as at the end of the work-day and to immediately clean up any area to its previous condition.

E. The Contractors shall employ methods to prevent the transmission of dirt from vehicles driving on exposed areas of the site from reaching the surrounding roadways. The Contractors will be responsible to immediately clean the roadway, should the measures being taken by the Contractors not satisfactorily control the transmission of any dirt to the roadway.

F. Any damages to areas outside the site, spills of soil, liquid, or any other material shall immediately be repaired, cleaned and restored to its previous condition.

G. The Contractors shall comply with all state and local requirements for allowable weight limits of vehicles on all roads.

H. The Owner reserves the right to back charge the Contractors for all costs associated with maintaining the grounds as well as maintaining areas outside the site, which may be disturbed by the Contractors should the Contractors fail to maintain or repair the aforementioned in a condition acceptable to the Owner.

1.03 CONTRACTOR USE OF THE PREMISES

A. Premises, for the purpose of this Contract, shall mean the site, buildings and other structures located within the property line or in any temporary or permanent construction easements identified on the plans.

B. The Contractors shall use and manage the premises and the associated construction activities as follows:

1. To not hinder the Owner's ability to operate their facilities.
2. To allow other Prime Contractors to install their work and complete their contractual obligations in the time period specified.
3. To allow for stockpiling of construction material and debris without any significant hardship, as defined by the Owner's Construction Representative, on the Owner or other contractors.
4. To allow for the stockpiling of excavated soil and imported fill, when called for, without any significant hardship, as defined by the Owner's Construction Representative, on the Owner or other contractors.
5. To allow utility companies to install their work.
6. To allow for the delivery of equipment and materials by independent trucking companies by leaving enough space for backing in and out of areas.
7. To allow for the safe, unimpeded travel way of the Owners vehicles, Owner's Construction Representative's vehicles, Architect/Engineer's vehicles, construction vehicles and heavy construction equipment about the entire site.

C. Contractors shall maintain the premises in a safe condition throughout the construction period. Compliance with OSHA regulations and site safety shall be the responsibility of the Contractor as it relates to work of the Contract. The posting of all applicable OSHA safety signs shall be the responsibility of the Contractors.

D. Contractors shall be responsible for protecting Owner's property. All existing buildings, structures, shrubs, trees, lawn fixtures, sculptures and misc. equipment shall be protected at all times. Any removals or relocation of said objects, if allowed shall be as directed by Owner's Construction Representative.

E. Contractors shall protect all of the physical structures, property and improvements upon the site from damage by their Work and shall immediately repair or replace damage caused by construction operations, employees or equipment employed by the Contractor. All labor, materials and equipment and outside contractors that are employed by the Owner to repair damage caused by the Contractor shall be billed to the Contractor directly or withheld from money due the Contractor for work already completed.

F. Immediately remove excess excavated material or relocate to areas on the site requiring placement of fill. Do not stockpile excess material on the site.

G. The construction site space is limited and it shall be the General Contractor's responsibility to manage the site during the entire construction period with input from all concerned parties as to meeting their needs. Equal consideration of the needs of others with that of the Contractor's shall be provided as judged by the Owner.

H. Due to the limited site area available for construction, staging areas shall be relocated several times during the various stages of construction. Additional compensation for relocating staging areas, equipment and material storage, and trailers are not to be considered an extra cost to the Contractor as this is an anticipated expense that shall be considered at the time of the bid.

I. Contractors are responsible for cleaning up their own materials and debris. Failure to maintain a clean work site daily, will result in other performing the work and Contractors being back charged for the cleaning cost plus construction administration fees.

J. Use of the existing building facilities during construction is prohibited including but not limited to: toilet rooms, telephone and water fountains. Contractors shall be fined ($250) per occurrence if their employee (or subcontractor's employee) is observed disregarding these rules.

K. Should it become necessary to access the existing building during construction hours for measurements or other non-disruptive work, the contractor shall be escorted by an Owner's Construction Representative.

L. Do not discard or dispose of any waste on-site.

M. Open fires will not be permitted on the site.

N. The Sitework Contractor shall employ erosion control measures to protect wetlands located adjacent to the work where shown on the Drawings and as required by regulatory agencies.

O. Install erosion control measures as indicated in the Contract. The Contractor shall confine stormwater runoff to the site.

1.04 CONTRACTOR STORAGE, PARKING AND DELIVERIES

A. Contractors must provide exterior storage containers when required. Final location of storage container shall be determined by the Owner.

B. Do not unreasonably encumber the premises with materials and equipment. Do not store material in existing buildings. Store all equipment and materials to allow the Owner's employees to operate and conduct their business safely.

C. Confine premise storage areas to locations designated by the Owner. Immediately repair or replace damaged facilities to the satisfaction of the Owner and to a condition that existed before the damage occurred as determined by preconstruction photographs, or if photographs are unavailable, to that deemed by the Owner.

D. No materials storage will be permitted within the buildings at any time during construction.

E. Storage of chemicals and paint materials shall be outside the existing or new structures and shall follow manufacturer's storage/handling guidelines.

F. Compressed gas containers shall be properly stored and secured per OSHA, to the satisfaction of the Owner. Failure to do so will result in a $250 back charge, per occurrence.

G. Contractors shall provide minimum of 48 hours advance written notice to the Owner's Construction Representative for deliveries of materials, site visits by inspectors, manufacturer's

representatives or any other occasion that impacts the use of the site. Contractors shall be responsible for any costs that are incurred by the owner, for failure to meet previously agreed upon appointments or work schedules.

H. Deliveries sent to the Owner will not be signed for or unloaded by the Owner. They will be directed to the construction site and if no employee is on site, the delivery will be rejected, at the contractor's expense.

I. Night deliveries of equipment (past the designated quitting time) will not be permitted. Do not schedule trucking companies to deliver equipment or wait for the job site to open. Delivery trucks shall not obstruct the site entrance, shall not sit within the neighborhood causing an obstruction or perceived nuisance, nor be left idling on or off the site for any period of time.

J. Parking shall be in the designated areas of the site only. All automotive type vehicles are to be locked when parked or unattended to prevent unauthorized use. Do not leave vehicles or equipment unattended with the motor running or the ignition key in place. Any vehicles or trucks in non-designated areas may be towed at contractor's expense.

1.05 WORK HOURS, EMPLOYEE CONDUCT AND MISCELLANEOUS EMPLOYEE REQUIREMENTS

A. The Contractors will be permitted to schedule working days and hours as specified in the General Terms and Conditions, if no times are specified therein then the work hours shall be Monday - Friday 8:00 am - 4:00 pm.

B. Employees are to act in a professional manner. Any employee using inappropriate language or who is disruptive to the work environment will be banned from the site.

C. Proper work attire is required. Shirts are to be worn at all times and no short pants are permitted.

D. Comply with the Owner's Identification and Personal Protection Policies. A copy of the current policy will be distributed at the initial job meeting.

E. Employees shall not converse with local residents or Owner's employees.

F. Any employee found under the influence of any drug or alcohol will be banned from the site.

G. The following items are not allowed on the Site or the Owner's premises. Any person observed to bear any of the following items will be immediately removed from the site.

1. Firearms, ammunition, weapons, and dangerous instruments (other than tools required for the work).
2. Alcoholic beverages or illegal controlled substances.
3. Cameras (except with written permission from the Owner).

H. Smoking is not permitted withing the building except for outdoors at least 100 feet from any window, louver, or door. Comply with the Owner's policies relating to smoking at the Site.

I. The Contractors shall schedule working days and hours as specified. The contractor shall pay all excess costs for working beyond the times specified. This includes the cost of the owner's employees to keep the building/site open and/or the cost of the additional services for the construction manager.

1.06 UNIFORM SAFETY STANDARDS - SECTION 155.5 - UNIFORM SAFETY STANDARDS FOR SCHOOL CONSTRUCTION AND MAINTENANCE PROJECTS.

Disclaimer: These Rules of the Regents and Regulations of the Commissioner of Education ("regulations") are unofficial, and are presented for general informational purposes as a public service. Although reasonable efforts have been made to ensure that these regulations are current, complete and accurate, the State Education Department does not warrant or represent that they are current, complete and accurate. These regulations are subject to change on a regular basis. Readers are advised to consult Title 8 of the Official Compilation of Codes, Rules and Regulations of the State of New York (8 NYCRR), published by the Department of State, and the State Register external link for the official exposition of the text of these regulations, as well as for amendments and any subsequent changes or revisions thereto.

A. Monitoring of construction and maintenance activities.
   1. The occupied portion of any school building shall always comply with the minimum requirements necessary to maintain a certificate of occupancy and shall be monitored during construction or maintenance activities for safety violations by school district personnel. It is the responsibility of the board of education or board of cooperative educational services to assure that these standards are continuously maintained when the building or any portion thereof is occupied.

B. Investigation and disposition of complaints relating to health and safety received as a result of construction and maintenance activities.
   1. Boards of education and boards of cooperative educational services shall follow procedures established under section 155.4(d)(7) of this Part.(c) Pre-construction testing and planning for construction projects.
      a. Boards of education and boards of cooperative educational services shall assure that proper planning is made for safety of building occupants during construction. For all construction projects for which bids are issued on or after September 30, 1999, such boards shall assure that safety is addressed in the bid specifications and contract documents before contract documents are advertised for bid. All school areas to be disturbed during renovation or demolition shall be tested for lead and asbestos. Appropriate procedures to protect the health of building occupants shall be included in the final construction documents for bidding.
      b. Boards of education and boards of cooperative educational services shall establish procedures for involvement of the health and safety committee to monitor safety during school construction projects. The health and safety committees in school districts other than in cities with one million inhabitants or more shall be expanded during construction projects to include the project architect, construction manager, and the contractors. Such committee shall meet periodically to review issues and address complaints related to health and safety resulting from the construction project. In the case of a city school district in a city of one million inhabitants or more, the board of education shall submit procedures for protecting health and safety during construction to the commissioner for approval. Such procedures shall outline methods for compliance with this section.

c. The district emergency management plan shall be updated to reflect any changes necessary to accommodate the construction process, including and be i updated emergency exit plan indicating temporary exits required due to construction. Provisions shall be made for the emergency evacuation and relocation or release of students and staff in the event of a construction incident.

d. Fire drills shall be held to familiarize students and staff with temporary exits and revised emergency procedures whenever such temporary exits and revised emergency procedures are required.

C. Pre-construction testing and planning for construction projects.

1. The board of education or board of cooperative educational services shall establish procedures for notification of parents, staff and the community in advance of a construction project of $10,000 or more to be conducted in a school building while the building is occupied. Such procedures shall provide notice at least two months prior to the date on which construction is scheduled to begin, provided that in the case of emergency construction projects, such notice shall be provided as far in advance of the start of construction as is practicable. Such notice shall include information on the district's obligations under this section to provide a safe school environment during construction projects. Such notice requirement may be met by publication in district newsletters, direct mailings, or holding a public hearing on the project to inform parents, students, school personnel and community members.

D. General safety and security standards for construction projects.

1. All construction materials shall be stored in a safe and secure manner.
2. Fences around construction supplies or debris shall be maintained.
3. Gates shall always be locked unless a worker is in attendance to prevent unauthorized entry.
4. During exterior renovation work, overhead protection shall be provided for any sidewalks or areas immediately beneath the work site or such areas shall be fenced off and provided with warning signs to prevent entry.
5. Workers shall be required to wear photo identification badges at all times for identification and security purposes while working at occupied sites.

E. Separation of construction areas from occupied spaces.

1. Construction areas which are under the control of a contractor and therefore not occupied by district staff or students shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the building. Periodic inspection and repairs of the containment barriers must be made to prevent exposure to dust or contaminants. Gypsum board must be used in exit ways or other areas that require fire rated separation. Heavy duty plastic sheeting may be used only for a vapor, fine dust or air infiltration barrier, and shall not be used to separate occupied spaces from construction areas.

a. A specific stairwell and/or elevator should be assigned for construction worker use during work hours. In general, workers may not use corridors, stairs or elevators designated for students or school staff.

b. Large amounts of debris must be removed by using enclosed chutes or a similar sealed system. There shall be no movement of debris through halls of occupied spaces of the building. No material shall be dropped or thrown outside the walls of the building.

c. All occupied parts of the building affected by renovation activity shall be cleaned at the close of each workday. School buildings occupied during a construction project shall

maintain required health, safety and educational capabilities at all times that classes are in session.

F. Maintaining exiting and ventilation during school construction projects.

1. The following information shall be included in all plans and specifications for school building projects:
   a. A plan detailing how exiting required by the applicable building code will be maintained during construction. The plan shall indicate temporary construction required to isolate construction equipment, materials, people, dust, fumes, odors, and noise during the construction period. Temporary construction details shall meet code-required fire ratings for separation and corridor enclosure. At a minimum, required exits, temporary stairs, ramps, exit signs, and door hardware shall be provided at all times.
   b. A plan detailing how adequate ventilation will be maintained during construction. The plan shall indicate ductwork which must be rerouted, disconnected, or capped in order to prevent contaminants from the construction area from entering the occupied areas of the building. The plan shall also indicate how required ventilation to occupied spaces affected by construction will be maintained during the project.

G. Fire and hazard prevention.

1. Areas of buildings under construction that are to remain occupied shall maintain a certificate of occupancy. In addition, the following shall be strictly enforced:
   a. (1) No smoking is allowed on public school property, including construction areas.
   b. (2) During construction daily inspections of district occupied areas shall be conducted by school district personnel to assure that construction materials, equipment or debris not block fire exits or emergency egress windows.
   c. (3) Proper operation of fire extinguishers, fire alarm, and smoke/fire detection systems shall be maintained throughout the project.

H. Noise abatement during construction and maintenance activities.

1. Construction and maintenance operations shall not produce noise in excess of 60 dba in occupied spaces or shall be scheduled for times when the building or affected building spaces are not occupied or acoustical abatement measures shall be taken. Noise level measurements (dba) shall be taken with a type 2 sound level meter in the occupied space in a location closest to the source of the noise. Complaints regarding excessive noise shall be addressed through the health and safety committee. The district should anticipate those times when construction noise is unacceptable and incorporate “no work” periods into the bid specifications.

I. Control of chemical fumes, gases, and other contaminants during construction and maintenance projects.

1. The bid specifications and construction contracts for each construction project shall indicate how and where welding, gasoline engine, roofing, paving, painting or other fumes will be exhausted. Care must be taken to assure fresh air intakes do not draw in such fumes.
   a. The bid specifications shall require schedules of work on construction and maintenance projects which include time for off-gassing of volatile organic compounds introduced during construction before occupancy is allowed. Specific attention is warranted for activities including glues, paint, furniture, carpeting, wall coverings, and drapery. Manufacturers shall be contacted to obtain information regarding appropriate temperatures and times needed to cure or ventilate the product during use and before safe occupancy of a space can be assured. Building materials or furnishings which off-gas chemical fumes, gases, or other contaminants shall be aired out in a well ventilated

heated warehouse before it is brought to the project for installation or the manufacturer's recommended off-gassing periods must be scheduled between installation and use of the space. If the work will generate toxic gases that cannot be contained in an isolated area, the work must be done when school classes and programs are not in session. The building must be properly ventilated and the material must be given proper time to cure or off-gas before re-occupancy.

b. Manufacturer's material safety data sheets (MSDS) shall be maintained at the site for all products used in the project. MSDS must be provided to anyone who requests them. MSDS indicate chemicals used in the product, product toxicity, typical side effects of exposure to the product and safe procedures for use of the product.

J. Asbestos abatement protocols.

1. All asbestos abatement projects shall comply with all applicable Federal and State laws including but not limited to the New York State Department of Labor industrial code rule 56 (12 NYCRR 56), and the Federal Asbestos Hazard Emergency Response Act (AHERA), 40 CFR part 763 (Code of Federal Regulations, 1998 Edition, Superintendent of Public Documents, U.S. Government Printing Office, Washington, DC 20402; 1998; available at the Office of Facilities Planning, Education Building Annex, Room 1060, State Education Department, Albany, NY 12234). Large and small asbestos projects as defined by 12 NYCRR 56 shall not be performed while the building is occupied. Minor asbestos projects defined by 12 NYCRR 56 as an asbestos project involving the removal, disturbance, repair, encapsulation, enclosure or handling of 10 square feet or less of asbestos or asbestos material, or 25 linear feet or less of asbestos or asbestos material may be performed in unoccupied areas of an occupied building in accordance with the above referenced regulations.

K. Lead paint.

1. Any construction or maintenance operations which will disturb lead based paint will require abatement of those areas pursuant to protocols detailed in the “Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing” (June 1995; U.S. Department of Housing and Urban Development, Washington, D.C. 20410; available at the Office of Facilities Planning, Education Building Annex, Room 1060, State Education Department, Albany, NY 12234). All areas scheduled for construction as well as areas of flaking and peeling paint shall be tested for the presence of lead and abated or encapsulated in accordance with the above noted guidelines.

L. Radon.

1. Districts shall take responsibility to be aware of the geological potential for high levels of radon and to test and mitigate as appropriate. This information is available from the New York State Department of Health Radon Measurement Database.

M. Post construction inspection.

1. The school district or board of cooperative educational services shall provide the opportunity for a walk-through inspection by the health and safety committee members to confirm that the area is ready to be reopened for use.

1.07 SECTION 155.7 HEALTH AND SAFETY IN EXISTING EDUCATIONAL FACILITIES

A. Facilities in school districts, other than city school districts in cities having 125,000 inhabitants or more, shall meet the following requirements and, in particular instances, such other requirements

as may be deemed necessary by the commissioner to insure the health and safety and accident protection of occupants.

1. Exits.
    a. There shall be at least two means of egress remote from each other, leading from each floor occupied by pupils, including basements.
        1) (i) When pupils enter into a corridor, there shall be a choice of two unobstructed means of egress in different directions.
        2) (ii) Handrails shall be provided on at least one side of stairways, and on both sides of stairways 88 inches or more in width.
        3) (iii) There shall be no storage under any stairs or landings unless the enclosure is of approved fire-resistant construction.
        4) (iv) Provision of fire escapes of approved design may be required where other exits are determined to be inadequate for fire safety.
    b. Dead-end corridor pockets shall not exceed a maximum depth of 11/2times the width of the pocket or 11/2 times the width of the corridor, whichever is less, unless otherwise approved by the commissioner.
    c. Corridors and exitways shall be kept clear and free of obstructions at all times.
    d. Fixed and portable security gates shall not be located or used where they will obstruct exits or create dead-end conditions for occupied spaces.
    e. Every space of pupil occupancy over 500 square feet in area shall have two separate means of egress from such space. A space of pupil occupancy is any room or self-contained space housing pupils on a regular basis, other than a place of assembly or small rooms where no more than 10 pupils are under direct, responsible, adult supervision. Each means of egress shall be in a separate smoke zone, unless immediately adjacent to an approved exit. The primary exit is commonly the opening to the corridor. The second means of egress may be a door opening into a separate smoke zone, or a door directly to the exterior, or a window of such size and design that will facilitate egress, or a door providing egress through adjacent spaces where specifically approved.
        1) Any point in a space of pupil occupancy shall not exceed a maximum of 50 feet straight-line distance to an exit, unless otherwise approved by the commissioner. Any additional exit necessary to satisfy this requirement shall be remote and may be required to be directly to the exterior.
        2) When spaces of pupil occupancy are defined in an open area by wardrobes, cabinetry and other furniture which does not present obstructions to egress and which allows students to circulate freely from one space to another, the total open space is considered, for exiting purposes, as a single space. Exits from such open-planned space shall meet requirements determined by the commissioner.
    f. Required emergency egress windows shall be of a size and design, including hardware and, in appropriate instances, steps or ladder to high sills, that will permit and facilitate emergency egress. Such windows shall be free of obstructing screens or storm sash.
        1) The minimum clear opening area for such windows shall be six square feet, with a minimum dimension of 24 inches, unless otherwise approved by the commissioner.
        2) At least one such window in each space of pupil occupancy shall be marked with an appropriate sign identifying it as an emergency egress window.

g. Places of assembly. A place of assembly is any area used for the assembly of 100 or more persons, and spaces over 1800 square feet in area used for the assembling of persons. A place of assembly shall have at least two exits remote from each other.
   1) Maximum occupancy for places of assembly shall be based on the number and size of existing approved exits on the basis of 50 persons for each one-half exit unit of 11 inches. Where existing exits are inadequate for the occupancy capacity of a place of assembly, or when directed by the commissioner, signs restricting the number of occupants shall be conspicuously posted at each exit location. Signs shall read in red letters on white background:
   "MAXIMUM OCCUPANCY --3" high, 3/4" stroke
   NOT TO EXCEED --2" high, 1/2" stroke
   XXX PERSONS" --3" high, 3/4" stroke

h. Courtyards with completely enclosed perimeters are areas of possible pupil occupancy and must be provided with exits as a space of pupil occupancy and as follows, unless otherwise approved by the commissioner:
   1) Enclosed courts up to a 700-square foot area shall have at least one exit equipped with hardware of a type which will always permit the door to be opened from the court side without the use of a key.
   2) Enclosed courts of more than a 700-square foot area shall have at least two exits, remote from each other, equipped with hardware of a type which will always permit the door to be opened from the court side without the use of a key.

i. Hardware.
   1) (i) All door hardware from spaces of pupil occupancy shall be of a type that will always permit the door to be opened from within the space without the use of a key.
   2) (ii) All exterior and interior doors in exitways, and exit doors from places of assembly shall have panic hardware, except that panic hardware is not required for push/pull interior exit doors if these doors have nonlatching hardware. Panic hardware shall not be required for exterior corridor doors serving less than three classrooms or for doors serving only service areas such as boiler room, kitchen or storerooms.
   3) (iii) Exit doors shall not be locked or chained or otherwise rendered inoperable from the inside at any time.

2. Smoke and fire control. As used in this subdivision, the terms Class "A", "B" or "C" refer to types of construction which are defined by subdivision 11 of section 11 of the Local Finance Law.
   a. In Class "B" and Class "C" buildings of two stories or more, unless otherwise approved, stairs shall be enclosed at each floor level and every floor shall be separated from levels above and below by stair enclosures and/or smoke barriers constructed to obstruct effectively the passage of smoke and fumes, or every space of pupil occupancy shall be provided with direct exit to the exterior. In appropriate instances, alternate means of egress may be required and stairway enclosures in Class "A" construction may be required.
   b. Class "B" and Class "C" buildings shall not have places of assembly above the first floor, except in a Class "B" building a written exception may be granted where it is determined by the commissioner that adequate exits exist.
   c. In appropriate instances, doors, walls and ceilings of places of assembly and exitways (corridors, stairs, vestibules, etc.) may be required to be finished with fire retardant materials or coatings.

d. Stairway enclosures required by paragraph (1) of this subdivision and smoke barriers required by paragraph (5) of subdivision (a) of this section shall be constructed of noncombustible materials of such design and detail to obstruct effectively the passage of smoke and fumes.
    1) Doors in stair enclosures and smoke barriers shall be metal, metal covered, approved treated wood construction, or solid bonded core wood doors not less than 13/4 inches thick.
    2) Glazing in doors, sidelights and frames shall be one-quarter inch wire glass.
    3) Such doors shall swing in the direction of egress, with no latching or locking devices unless operated by panic hardware. Double-acting hinged doors are not permitted and corridor pockets opposing swing of doors shall conform to the provisions of paragraph (2) of subdivision (a) of this section.
    4) Such doors shall be self-closing and maintained in a normally closed position unless approved automatic release devices are provided, whereby upon interruption of an electrical circuit, the door is released and becomes self-closing. The electrical circuit shall be positively interrupted by operation of an approved smoke detection system and/or activation of the building fire alarm system. Fusible links shall not be used to hold open such doors.

e. Wood floors shall not be treated or finished with oil. Floors so finished previously shall be cleaned and refinished with a penetrating seal.

f. Fire extinguishers shall be located so that no point in a corridor, lobby or stair is more than 120 feet from an extinguisher. Fire extinguishers shall also be placed readily accessible to auditorium stages, shops, cafeterias and kitchens, boiler rooms, science labs and accessible from other places which are possible sources of fire. Fire extinguishers shall bear the Underwriter's label and be of a type most suitable for the kind of fire most likely to occur in a given area.

g. Fire-resistive (hourly rated) floors, interior walls and doors, and ceilings shall be provided at the following spaces unless otherwise approved by the commissioner. Those spaces having a roof over the entire space may have roof construction and ceilings of non-rated fire-resistive materials.
    1) Two-hour fire-rated construction with 11/2 hour fire-rated, self-closing fire doors are required at:
        (a) boiler, heater or furnace rooms;
        (b) refrigeration, electrical and equipment rooms;
        (c) incinerator rooms;
        (d) storerooms for fuel, flammable liquids and gas powered equipment; and
        (e) transformer vaults.
    2) Required fire doors shall be maintained in a normally closed position and not held open by fusible links.
    3) Combustible attic space shall not be used for storage.

3. Accident protection.
    a. Glazing of panels and doors shall be with safety glazing materials as follows, unless glazed areas are protected by approved grilles or rails:
        1) interior exit doors, exterior exit doors and immediately adjacent sidelights, except where glazing is 48 inches or more above the floor;
        2) all glazed panels where glazing is within 18 inches of the floor, or platform level of music-room type risers;
        3) gymnasiums and playrooms and elsewhere where subject to physical abuse;

4) acceptable safety glazing materials shall be at least one-quarter inch thick wire glass, one-quarter inch tempered (heat treated) glass, one-quarter inch laminated safety glass, or approved plastic materials.

b. Glazed doors and sidelights within six feet of such doors shall be marked by appropriate means in accord with the provisions of Part 47 of Title 12 of the Official Compilation of Codes, Rules and Regulations of the State of New York, except marking on door and/or sidelight is not required:
   1) where less than 80 percent of the area of the door or sidelight above a reference line 18 inches above the floor is glazed;
   2) where width of sidelight is not more than 20 inches, with 1 3/4 inch minimum opaque stiles;
   3) where floor treatment a distance of three feet out from a sidelight will deter approach;
   4) where sidelights are supported on 18-inch minimum height opaque sill and wall construction;
   5) where sidelights are protected by approved 18-inch minimum height permanent barriers such as benches, planters or guardrails, extending across at least two thirds of the sidelight.

c. Window cleaning. Safety provisions shall be made for persons engaged in window cleaning. Windows shall be cleaned from approved safe surfaces, windowsills or ledges, boatswain's chairs or scaffolds, all as defined in Part 21 of Title 12 of the Official Compilation of Codes, Rules and Regulations of the State of New York.
   1) A safe surface is a place where the cleaner is working not over six feet off the floor or grade and not over three feet above a stair run. Ladders may be used generally when the top of the window is not over 35 feet above grade or floor. Windowsills and ledges may be used when the window openings are provided with approved anchors for use with safety belts. Approved boatswain's chairs and scaffolds also may be used.

4. Mechanical. Mechanical equipment, heat-producing and cooling equipment, auxiliary apparatus and controls, and installation and use of same, shall be such as will insure safe operation in accord with applicable recognized standards, as determined by the commissioner, and be consistent with efficient energy consumption.
   a. Gas and oil fuel-burning equipment having a capacity of over 400,000 BTU per hour shall be provided with electronic flame safeguard controls which, upon flame failure, shall normally respond in two to four seconds to cut off fuel supply through the burner and main fuel valve.
   b. All primary controls for fuel-burning equipment shall operate on a 120- volt, single- phase grounded circuit. Such controls generally include the hold-in coil of the motor starter, the solenoid coil for the pilot valve, the solenoid coil for the main fuel valve or the actuator for the motorized fuel valve, the ignition transformer and the modulator transformer.
   c. Direct-fired fuel-burning heating units shall not be used in any space of pupil occupancy.
   d. Unused duct work shall be sealed off at each floor level with fire-resistive materials.
   e. Ventilation with fresh air shall be available in all occupied spaces.
5. Water and sanitation.
   a. An adequate supply of safe, potable water for drinking shall be dispensed from approved sanitary drinking fountains.

b. Toilet rooms for boys and girls, with flush toilets and wash sinks which are connected to an adequate water supply under pressure, and connected to an approved individual or public sewage disposal system, shall be provided.
c. No source of water supply, nor sewage disposal system, shall be used which has not been approved by the appropriate agency of the State Department of Health or Department of Environmental Conservation.

6. Gas.
   a. Gas entering a school building shall be low-pressure gas.
   b. Gas transmission and distribution piping shall meet the requirements of the Public Service Commission.
7. Electrical. Electrical equipment and auxiliary apparatus and controls, and installation and use of same, shall be such as will insure safe operation in accord with applicable recognized standards, as determined by the commissioner, and be consistent with efficient energy consumption.
   a. Suitable and sufficient artificial light shall be provided for the visual tasks being performed.
   b. Exit lights. School buildings shall be provided with exit lights to identify building exits, stairs, corridors, and exits from places of assembly, and to designate the path of travel to the exterior, except school buildings having six or less classroom areas may have exit signs in place of exit lights.
      1) The word "EXIT" shall be in letters not less than 4 1/2 inches high and strokes not less than 3/4 inches wide.
      2) Exit lights shall be circuited and wired to minimize the possibility of interruption.
   c. Emergency lighting. Automatic emergency lighting systems shall be provided for places of assembly exceeding an area of 1800 square feet, and for all exitways leading from such areas. Such areas include all-purpose rooms, auditoriums, cafeterias, group-instruction rooms, playrooms and gymnasiums, swimming pools and other combination places of assembly.
   d. Fire alarm.
      1) School buildings of seven or more classroom areas shall be equipped with a manually operated electric fire-alarm system, which may include automatic smoke and/or fire detection, which will continue to sound the alarm until the tripped station has been restored to normal operation or, in an existing system, has completed a cycle of not less than 30 seconds.
      2) School buildings of one to six classroom areas shall be equipped with either a manual, hand or electric, fire alarm which is capable of being sounded for such a period of time as will insure evacuation of the building, or an electric fire-alarm system as described in subparagraph (i) of this paragraph.
      3) School buildings within fire districts having an electrically operated, street-located general municipal fire-alarm box system shall have, wherever practical, the school building fire-alarm system interconnected to the municipal system, so that sounding of the school building fire-alarm system automatically gives the alarm to the fire department affording protection to the school building. Wherever practical, a fire-alarm box compatible with the municipal system, which will sound the alarm of the school building system, shall be accessibly located on the site or on the school building.
   e. Telephone. A telephone which can be used in the case of emergency shall be provided in all buildings having pupil occupancy.

8. Additions and alterations. In the case of additions to or alterations of an existing facility, the requirements of this section must be continuously maintained during the construction period, or provisions made to provide equivalent safety to the school-district-occupied portions of the facility.
9. Facilities shall be operated and maintained to provide effectively for the accident protection and life safety of occupants, to reduce exposure to property loss by fire, and to assure efficient use of natural resources.
10. When, based on these regulations, it is the judgment of the commissioner that the general conditions of a school building, or any part thereof, indicate that it would be detrimental to the health and safety of occupants, the commissioner may designate an area or areas of the building as unusable for pupil occupancy or may limit the number of occupants thereof.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Site Utilization Plan requirements

1.02 SITE UTILIZATION PLAN REQUIREMENTS

A. Each Contractor shall prepare a Site Utilization Plan (SUP) showing staging areas, parking areas, stockpile areas, debris container areas, unloading areas, and trailer areas for review by the Architect/Engineer and Owner's Construction Representative. The length and number of meetings necessary to develop and adopt a SUP shall be as required.

B. Meetings will be held at the site with all concerned parties to assist the Contractor in developing the criteria for the plan. During these meetings, all parties will present their needs and requirements for site utilization. Representatives from the local municipality or utility companies may be attending. The requirements of the local municipality and utility companies shall be incorporated into the SUP.

C. Each Contractor shall then prepare a draft site plan that attempts to incorporate the needs of all concerned parties. Another meeting will then be held at the site to review and present the plan. The plan shall then be revised at that meeting and adopted for use if it is acceptable to all relevant parties. If all parties cannot agree on an acceptable plan, then the Owner's Construction Representative will establish the Site Utilization Plan without any claims from any contractor.

D. Each Contractor, by submitting a bid, understands the importance of a workable Site Utilization Plan and also understands that the Owner's Construction Representative may be required to select a plan for the contractor to adopt that is not ideal to the planned construction activities anticipated before the bid was submitted. There shall be no claims for damages associated with site utilization.

E. If the General Contractor fails to prepare the Site Utilization Plan as stipulated above, then the Owner reserves the right to back charge the Contractor for the costs associated with having a Site Utilization Plan developed.

F. If a Prime Contractor fails to participate or attend the meetings scheduled to develop the Site Utilization Plan then the Prime Contractor will forfeit any right to comment on the plan that is developed.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 011419

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Allowance pricing for the following items:
   1. Contingency Account.
B. This Section covers the requirements for use of the cash allowances listed above contained in the proposal (Bid Forms, Price Schedule) and included in the Contract Price bid by the Contractor and defines and stipulates the charges that will be paid for out of the stipulated allowances.
C. The Contractor shall include the cash allowances stipulated in this Section in the amount bid (Base Bid).
D. Eligible costs described in this Section, and Sections referenced herein, will be the only costs paid for out of the stipulated allowances.
E. All other costs associated with the project as specified and/or shown, including but not limited to the delivery, installation and all Contractor overhead and/or collateral expenses are to be distributed among the other portions of the work and shall be included in the lump sum base bid.

1.02 SUBMITTALS

A. Make all submissions under the provisions of Section 013300.
B. For each type of product/material specified to be furnished under allowance pricing provide documentation of the unit pricing on manufacturer's letterhead certifying pricing of the product/material.
C. Submit additional backup information to substantiate the invoiced amount(s) as the Architect/Engineer may require for review and approval, prior to order or payment of item.
D. Provide written breakdowns for extra work as the Owner may require.

1.03 CHANGES TO STIPULATED (CASH) ALLOWANCE

A. If the actual cost of services differs from the cash allowance, then the Contract Price will be adjusted accordingly.

1.04 PAYMENTS TO BE MADE OUT OF CONTINGENCY ACCOUNT

A. Include the cash allowance as shown in the proposal, in the amount bid for use upon the Owner's instructions.
B. The Owner will draw funds from the contingency account only upon prior written approval by the Owner's Construction Field Representative and Architect/Engineer.
C. Funds remaining at project closeout shall be credited to the Owner.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies the requirements for measurements and records made for payment purposes and describes the item(s) under which payment(s) will be made for the Work performed under this Contract.

B. All work shown or specified in the Contract Documents shall be performed.

C. Items not specified to be measured or paid for (for which no specific pay item exists in the Price Schedule) shall be included in an appropriate unit price item or in a lump-sum item.

D. Comply with the requirements pertaining to the restoration of all surfaces, which may or may not be paid for under a separate unit price item, and which shall be restored to a condition equal to or better than that existed prior to work starting under this contract.

1.02 MEASUREMENT REQUIREMENTS

A. All required measurements shall be made by the Contractor with the Architect/Engineer.

B. Any measurements not witnessed by Architect/Engineer and which cannot be verified or substantiated by Architect/Engineer will not be approved and payment under the item(s) requiring such measurements will not be made.

C. Coordinate measurements monthly, for the preparation of periodic pay estimates.

D. Where payments will be made for removing rock and existing materials, notify Architect/Engineer so that he may witness the measurements.

1. All materials removed without conforming to the above procedures, which Architect/Engineer cannot verify or substantiate, will not be paid for.
2. Maintain complete, neat, clean, and legible field notes for all measured items.
3. Notes shall contain spaces for Contractor’s and Architect/Engineer’s signatures plus additional space for comments.
4. An original and a carbon copy shall be made for all notes and one copy shall be turned over to Architect/Engineer daily.
5. The Architect/Engineer’s signature shall not be constituted as an acceptance of the work, or the measurements made, but shall mean that he was present when the measurements were made.

1.03 SUBMITTALS

A. Field notes of all measurements for payment purposes delivered to Architect/Engineer daily.

B. Copies of all invoices required for payments out of cash allowance(s).

C. Monthly Applications for Payment.

D. Record Drawings showing the locations and quantities of all items measured for payment purposes.

1.04 SCHEDULING

A. Notify Architect/Engineer, as far in advance as possible, of the recording of measurements so that a representative of the Architect/Engineer may observe existing conditions, work being performed, and measurements being made.

B. Allow for and afford Architect/Engineer ample time, space, and equipment to observe measurements and to verify measurements and elevations.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide all labor, materials, facilities, levels, measuring devices and all other equipment and items necessary to properly and accurately perform all measurements for payment purposes.

B. Payment for certain items not specifically listed in the bid forms but otherwise required by the technical specifications shall be deemed included as part of the General Conditions and the individual unit price and lump sum bid items provided for in the proposal.

PART 3 - EXECUTION

3.01 GENERAL

A. Perform all measuring required under this Section.

B. Record all measurements and calculated quantities on the Record Drawings.

C. No measurement shall be made for work performed within the limits of Lump Sum Items.

ITEM NO.	**ITEM DESCRIPTION**
1	

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Submission procedures.

B. Documentation of changes to Contract Sum/Price and Contract Time.

1.02 RELATED SECTIONS

A. Proposal Form.

B. Other sections referencing this section.

C. All contractual requirements outlined in the documents.

1.03 SUBMISSION REQUIREMENTS

A. Submit Alternates on Proposal Forms identifying the effect on adjacent or related components.

B. Alternates will be reviewed and accepted or rejected at the Owner's option.

C. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.04 SELECTION AND AWARD OF ALTERNATES

A. Indicate variation of Bid Price for Alternates listed on the PROPOSAL FORM. This form requests a "difference" in Bid Price by adding to or deducting from the base Bid Price.

B. Alternates quoted on PROPOSAL FORM will be reviewed and accepted or rejected at Owner’s option.

C. Accepted alternates will be identified in Owner-Contractor Agreement.

D. Bids will be evaluated on the base bid price, plus any combination of alternate items.

1.05 WORK FOR ALTERNATES

A. Work for alternate items selected shall include all related materials, labor, equipment and operations necessary to conduct and complete the alternate work and all other affected work or adjacent areas.

B. There shall be no change in time or completion date for the selected alternates, unless specified herein or approved in writing by the Architect/Engineer and Owner.

C. Alternates and associated work shall meet all standards and specifications delineated in the Contract Documents.

D. Contractor shall coordinate pertinent related Work and modify surrounding Work as required to complete the project under each alternate selected by the Owner.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 PROCEDURES

A. Work for each alternate, related items and collateral work shall be completed in their entirety.

B. If alternate items are not selected, work for the base bid and collateral work shall be completed in their entirety.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. **This Section includes the requirements for substitution of specified products during construction.**

B. *The Architect/Engineer will consider requests for substitutions only within **two (2)** business days following the Bid Opening.*

C. Products named by the Bidder, at the time of bid, shall be furnished and installed and substitutions will not be considered by the Owner/Architect/Engineer for those products.

1.02 CONTRACTOR'S OPTIONS

A. For products specified only by reference standard, select any product meeting that standard.

B. For products specified by naming several products or manufacturers, select any one of the products or manufacturers named which complies with the Specifications.

C. Where products are not named, then submit products that meet the specifications.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Name - The Drawings and Specifications list acceptable manufacturers, commercial names, trademarks, brands and other product, material and equipment designations. Such names are provided to establish the required type, quality and other salient requirements of procurement.

B. Equals - An item equal to that named or described on the Drawings or in the Specifications may be provided by Contractor if accepted in writing by the Architect/Engineer.

C. A request for product substitution constitutes a representation that the Contractor:

1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
2. Shall provide the same warranty for the Substitution as for the specified Product.
3. Shall coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner, including extra charges by other Prime Contractors, material suppliers, and vendors.
4. Waives claims for additional costs or time extension that may subsequently become apparent.
5. May be responsible to reimburse the Owner <> for review or redesign services associated with re-approval by authorities, if required.
6. May be responsible to reimburse the Owner for all additional A/E services needed by the Architect/Engineer for extra services associated with the review of the Contractor's substituted item since it could not have been originally included in the Architect/Engineer's professional engineering services agreement. Reimbursement shall be based on the man-hours expended, at current billing rates. A copy of the billing rates will be provided to the contractor for approval prior to services being provided.

D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

E. Substitution Submittal Procedure:

1. The Contractor shall submit three (3) copies of the REQUEST FOR SUBSTITUTION FORM for consideration including all required information.
2. The Contractor shall use the form included within this Section.
3. All forms shall be type written.
4. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence.

F. The burden to prove product equivalence rests on the Contractor.

G. The Architect/Engineer will notify Contractor in writing of decision to accept or reject request and at that time the Contractor can make a formal submittal in accordance with the requirements contained in Section 013300.

H. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor or the Architect.

PART 3 - EXECUTION

NOT USED

This space left intentionally blank.

REQUEST FOR SUBSTITUTION FORM

Project: Fitness Center Redesign at Harrison High School	Substitution Request Number:_____
Contractor:_____	
Address:_____	
To:_____	Date:_____
H2M Project Number: HCSD2401E	Owner: XYZ Corporation
Contract Name:_____	Contract No.:_____
Specification Title:_____	
Section:_____	Page:_____ Article/Paragraph:_____
Drawing No(s).:_____	
Proposed Substitution:_____	
Manufacturer:_____	Address:_____
Trade Name:_____	Phone #: (____)_____
Installer:_____	Address:_____
Phone #: (____)_____	
History: ___New product ___2-5 years old ___5-10 years old ___More than 10 years old	
Differences between proposed substitution and specified product:	
___Point-by-point comparative data attached	
Reason for not providing specified item (Attach separate sheet if necessary):	

Typical Similar Installation:

Project:_____

Engineer /
Architect:_____

Address:_____

Owner:_____

Date Installed:_____

Submit complete installation list on separate sheets.

Proposed substitution affects other parts of Work: ___No ___Yes

Explain:_____

Gross Savings to Owner for accepting substitution: $_____

Proposed substitution changes Contract Time: ___No ___Yes

Add / deduct (circle):_____ days

Supporting data attached for evaluation of the proposed substitution:

___Product Data ___Photos ___Drawings ___Tests ___Reports ___Samples

___Other (explain):_____

Attached data includes description, specifications, drawings, photographs, performance and test data adequate for evaluation of request; applicable portions of data are clearly identified.

Attached data also includes a description of changes to Contract Documents that proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:	
1.	Proposed Substitution has been fully checked and coordinated with Contract Documents.
2.	Proposed Substitution does not affect dimensions shown on Drawings.
3.	Proposed Substitution does not require revisions to any other Prime Contractor's work.
4.	The undersigned will pay for changes to building design, including Architectural and Engineering design, detailing, and construction costs caused by requested Substitution.
5.	Proposed Substitution will have no adverse affect on other trades, construction schedule, or specified warranty requirements.
6.	Maintenance and service parts will be locally available for proposed substitution.
7.	The undersigned further states that the function, appearance, and quality of proposed Substitution are equivalent or superior to specified item.
This request for product substitution also constitutes a representation that I, as the Contractor:	
1.	Has investigated proposed Product and determined that it meets or exceeds the quality of the specified Product.
2.	Shall provide the same warranty for the Substitution as for the specified Product.
3.	Shall coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner, including extra charges by other Prime Contractors, material suppliers, and vendors.
4.	Waives claims for additional costs or time extension that may subsequently become apparent.
5.	Shall reimburse the Owner and the Architect/Engineer for review or redesign services associated with re-approval by authorities.
6.	Shall reimburse the Owner for all additional engineering services claimed by the Architect/Engineer for extra services associated with the review of the Contractor's substituted item since it could not have been originally included in the Architect/Engineer's professional engineering services agreement. Reimbursement shall be based on the man-hours expended, at current billing rates.
Contractor's Authorized Representative (Typewritten):_____	
Authorized Signature:_____	
Date:_____	

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work under this Section specifies the procedures used to process partial payments and the Final Payment Request.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements governing each prime contractor's Applications for Payment.
   1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.

B. Related Sections: The following Sections contain requirements that relate to this Section.
   1. Schedules: The Contractor's Construction Schedule and Submittal Schedule are specified in Division 01 - Section 013300 - {\t\#1000058}.

1.03 TIME FOR COMPLETION

A. Inasmuch as the provisions of the Contract relating to the time for performance and completion of the Work are for the purposes of enabling the Owner to proceed with the construction of a public improvement in accordance with a predetermined program, and inasmuch as failure to complete the Work within the period herein specified may result in damage or loss to the Owner, time is of the essence of the Contract.

B. Time for completion of the Work shall be in accordance with that stipulated in the Contract Documents.

C. The date for completion will be calculated from the date shown on the Notice to Proceed. The Contractor shall execute the Work with diligence from day to day, and complete it within the time fixed.

D. For the purpose of defining the date of substantial completion, the Project will be considered complete when all Work covered by the Contract has been performed and all installations and equipment have been tested and are ready for permanent use. Contractor shall provide a copy of the final Certificate of Occupancy from the AHJ prior to issuance of the final payment. Removal of the Contractor's plant and equipment and other minor adjustments which do not prevent use of the Project will not be a factor in establishing the date of substantial completion.

E. Notwithstanding the foregoing, the Architect/Engineer will establish the date of substantial completion when the project is accepted and ready for operation, and no large or major items of work are as yet outstanding. At such time, the Architect/Engineer will issue a punch list, itemizing the items of work remaining. The punch list will include "minor" items only, as defined solely by the Architect/Engineer. Any prior punch lists, which include "major" or significant items, as defined by the Architect/Engineer, shall not be a criterion in establishing the date of substantial completion.

1.04 PARTIAL COMPENSATION

A. At the Owner’s discretion, the Contractor may receive compensation for materials and products delivered to the site yet not installed providing:
   1. A canceled check or paid bill from the supplier is submitted to the Architect/Engineer indicating that the Contractor has paid the supplier for the material or equipment.
   2. The material or piece of equipment is properly stored and protected from the elements and/or vandalism in accordance with the manufacturer’s written requirements for long term storage.
   3. A certificate of insurance is provided for the material or piece of equipment in the event of a fire, vandalism, theft, etc.
   4. A bill of material is delivered to the Architect/Engineer at the time of delivery itemizing the subject material or equipment. Payment will be made for on-site material and/or equipment in the amount of 80% of the gross amount of the paid invoice. This payment will be subject to the normal retainage of the partial estimate.
   5. The Architect/Engineer has agreed to the pre-purchasing of the materials.
B. The Contractor may not receive compensation for materials and products stored in the Contractor’s yard or shop unless permitted by the Owner.

1.05 SCHEDULE OF VALUES

A. Coordination: Contractor shall coordinate preparation of its Schedule of Values for the Work with preparation of the Contractors' Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
      a. Contractor's Construction Schedule.
      b. Application for Payment forms, including Continuation Sheets.
      c. List of subcontractors.
      d. Schedule of allowances.
      e. Schedule of alternates.
      f. Schedule of submittals.
   2. Submit the Schedule of Values (SOV) to the Owner's Construction Representative within 10 days of receipt of Letter of Intent but no later than 10 days before the date scheduled for submittal of the initial Applications for Payment. (SOV received after the 15 day of the month, will not be accepted for review until the following month to allow for computer system input time required by the Owner's Construction Representative and the Owner.
B. Format and Content: Use the Project Manual table of contents as a guide to establish the format for the Schedule of Values. Provide at least one item for each Specification Section.
   1. Identification: Include the following Project Identification on the Schedule of Values:
      a. Project name and location. (Each school and additions / renovations will require separate breakdown sections and front end with subtotals.
      b. Name of the Architect/Engineer.
      c. Architect's Project Number.
      d. Contractor's name and address.
      e. Date of Submittal.
   2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

a. Related Specification Section or Division.
b. Description of Work.
c. Name of subcontractor.
d. Name of manufacturer or fabricator.
e. Name of supplier.
f. Change Orders (numbers) that affect value.
g. Dollar value.
    1) Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items where requested by Owner's Construction Representative. Multiple line items will be provided for amounts in excess of five percent of the contract sum, broken out into sub components equating not greater than five percent each. Separate all line items by material & labor.
    a. Breakdown shall be separated between additions and renovations with subtotals for each.
4. In addition to the breakdown of specification sections , separate line items will be required for the following front-end line items:
    a. Bonds & OCP insurances shall have separate line items. (substantiation letters shall be required from bonding & insurance company for any amounts higher than industry standard). Only OCP insurance shall be allowed for the insurance line item. All other insurance costs must be distributed by contractor throughout the various sections.
    b. Supervision: include a minimum of one percent of contract value.
    c. Project Administration: include a minimum of one percent of contract value.
    d. Project meetings (appropriate value for weekly attendance for entire duration of project - see Section 013119 Project Meetings).
    e. Punchlist - include a minimum of two (2) percent of contract sum.
    f. Closeout: separate lines for demobilization, Operation & Maintenance manuals, closeout paperwork and Demonstration & Training. All totaling a minimum two (2) percent of the Contract value.
    g. Continuous Clean-up and Final Clean-up values each at a minimum of one half percent (0.5 % of the Contract value).
    h. The General Construction Contractor shall add a line item for broom sweep/ damp mopping at an agreed to value.
5. Round amounts to nearest whole dollar; the total shall equal the Contract Value.
6. Provide a separate line item in the Schedule of Values (SOV) for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.
    a. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing.
7. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Unit-Cost Allowances: Show the line-item value of unit-cost allowances, as a product of the unit cost, multiplied by the measured quantity. Estimate quantities from the best indication in the Contract Documents.
9. Margins of Cost: Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of

Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.

a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expenses, at the discretion of the Contractor.

10. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Value.

1.06 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.

1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

B. Payment-Application Times: Each progress-payment date is indicated in the Agreement. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment-Application Times: The date for each progress payment is the 21st day of each month (or as designated by the Owner). The period covered by each Application for Payment is the previous month.

D. Payment-Application Forms: Use AIA Document G732/CMa (include line for Owner's Construction Representative signature) and Continuation Sheets G703 as the form for Applications for Payment.

1. Separate Continuation Sheets shall be provided for work which takes place on each building, which will detail that portion of the contract which is attributable to the specific building. The appropriate S.E.D. project number(s) shall be shown on the top of each continuation form.

E. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Owner's Construction Representative will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Allowances issued prior to the last day of the construction period covered by the application. (No Change order or Allowance requisitions can be made or listed on the requisition, unless the formal Change Order and Allowance paperwork has been fully executed by Contractor, Owner's Construction Representative, Architect and Owner).
3. Provide copies of payrolls which are signed and notarized documenting compliance with prevailing wage laws. Payrolls for contractors are required from the of the previous month to the 24th day of the current month. Payrolls for subcontractors are required from the 15th day of the previous month to the 14th day of the current month.
4. Provide copies of Lien Waivers for the previous payment (or anticipated payment). Include certificate of monthly payment for subcontractors for the previous month.
5. Provide OSHA 10 certificates for all workers on site.

6. Payment for stored materials (whether on-site but not installed, or offsite in a secured warehouse) will require a Bill of Lading showing the exact value accompanied by photographs of the actual materials. In no case shall more that 80% be approved for uninstalled stored materials. An Insurance certificate must be provided, specific to the materials stored with the appropriate dollar value (for on-site or offsite materials).

F. Transmittal: Submit five (5) signed and notarized original copies of each Application for Payment to the Owner's Construction Representative by a method ensuring receipt within 24 hours. Each copy shall be complete and securely attached and shall include all waivers of lien, certified payrolls and similar attachments.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect and Owner's Construction Representative.

G. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics liens from subcontractors, sub-subcontractors and suppliers for the construction period covered by the previous application.

1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
    a. Submit final Applications for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
4. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the Owner.

H. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment include the items listed below. The initial payment application will not be processed until all of these actions and submittals have been received by the Owner's Construction Representative. When preliminary submissions are received with the initial application (item 4 and item 7 listed below), the final submission for these items must be received and approved by the Owner's Construction Representative prior to submission of the second application for payment.

1. List of subcontractors.
2. List of principal suppliers and fabricators.
3. Schedule of Values.
4. Contractor's Construction Schedule (preliminary if not final).
5. Schedule of principal products.
6. Schedule of unit prices.
7. Submittal Schedule (preliminary if not final).
8. List of Contractor’s staff assignments.
9. List of Contractor’s principal consultants.
10. Copies of building permits.
11. Copies of authorizations and licenses from governing authorities for performance of the Work.

12. Initial progress report.
13. Report of preconstruction meeting.
14. Certificates of insurance and insurance policies.
15. Performance and payment bonds.
16. Data needed to acquire the Owner's insurance.
17. Initial settlement survey and damage report, if required.

I. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.

1.07 ACCEPTANCE OF FINAL PAYMENT REQUEST

A. The Contractor shall be conclusively deemed to have accepted the Final Payment Request as a correct statement of the total liability of the Owner and of the compensation paid and to be paid to the Contractor by the Owner unless within seven (7) days after delivery of his copy of the Final Payment Request to him, the Contractor shall return such copy to the Owner together with a statement of his objections to such request and of any claim for damages or compensation in excess of the amounts shown on the Request. The acceptance by the Contractor of the Final Payment Request approved by the Owner shall constitute a release and shall discharge the Owner from all further claims by the Contractor arising out of or relating to the Contract, including but not limited to, a release from all impact costs.

1.08 SCOPE OF PAYMENTS

A. The Contractor shall receive and accept the compensation as herein provided, in full payment for furnishing all materials, labor, tools, and equipment and for performing all work contemplated and embraced under the Contract, also for all loss or damage arising out of the nature of the Work or from the action of the elements, or from any unforeseen difficulties or obstructions which may arise or be encountered during the prosecution of the Work, and for all risks of every description connected with the prosecution of the Work, until its final acceptance by the Owner, also for all expenses incurred by, or in consequence of, the suspension or discontinuance of the said prosecution of the Work as herein specified, and for all actual or alleged infringements of patent, trademark, or copyright, and for completing the Work and the whole hereof, in an acceptable manner, according to the Plans, Specifications, and other Contract Documents. The payment of any partial or final estimate shall in no way or in no degree prejudice or affect the obligation of the Contractor, at his own cost and expense, to renew or replace all defects and imperfections, or damages. The Architect/Engineer shall be the judge, and the said Contractor shall be liable to the Owner for failure so to do.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

NOT USED.

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work of this Section includes:
   1. Requests for Interpretation or for information
   2. Administration of subcontracts
   3. Communication and coordination requirements

B. Site staffing requirements for the Contractor's superintendent are also specified herein, the costs for which shall be included in the Contract price.

1.02 REQUEST FOR INTERPRETATION OR INFORMATION

A. The Contractor shall use the Request for Interpretation/Information Form included within this Section when the Contractor feels that additional information is needed to perform the work of the Contract.

B. The Architect/Engineer will respond to requests utilizing the form provided herein.

C. The Architect/Engineer's verbal response(s) to the Contractor's formal requests, if provided, shall not constitute an official response and if acted upon by the Contractor are done so at the Contractor's own risk and liability and shall not be subject to claims for additional compensation.

D. A signed facsimile of the form will be accepted. The original of the form must be signed and provided to the project manager.

E. The Architect/Engineer will respond in writing to the request as soon as possible.

1.03 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report recording the following information concerning events at the site, and submit one copy to the Owner's Construction Representative by 10:00 a.m. the following day. Any contractor not submitting required reports will not receive approval of the subsequent application for payment until such time that all required information is submitted:
   1. List of subcontractors at the site.
   2. Count and names of personnel at the site.
   3. High and low temperatures, general weather conditions.
   4. Accidents and unusual events.
   5. Meetings and significant decisions.
   6. Stoppages, delays, shortages, and losses.
   7. Meter readings and similar recordings.
   8. Emergency procedures.
   9. Orders and requests of governing authorities.
   10. Change Orders received, implemented.
   11. Services connected, disconnected.
   12. Equipment or system tests and startups.
   13. Partial Completions, occupancies.
   14. Substantial Completions authorized.

1.04 SUBCONTRACTOR ADMINISTRATION AND COORDINATION

A. Terms and conditions of the Contract shall be binding upon each subcontractor.

B. Furnish each subcontractor and major equipment vendor at least one (1) copy of the Plans and Technical Specifications.

C. Provide at least one (1) copy of each approved shop drawing to each subcontractor whose work may depend upon the contents of the shop drawing submittal. The Owner reserves the right to stop all work, without claims for delay, until such time as appropriate subcontractors are furnished with appropriate shop drawings.

D. Each Contractor shall sequence and schedule the work of subcontractors. Coordinate construction and administration activities of subcontractors. The Architect/Engineer and Owner will not accept telephone calls, facsimiles or office visits from any subcontractors on the project. Subcontractor and vendor questions and clarifications shall be directed to the Architect/Engineer by the Contractor.

E. The Contractor's on-site project superintendent shall inspect all the work of all of his/her subcontractors, as it is being constructed. The Contractor's subcontractor shall not be permitted to do any work on the site without the Contractor's job site superintendent also being there to inspect the work as it is being performed.

1.05 UTILITY COORDINATION

A. Comply with the requirements of 16 NYCRR Part 753 - Protection of Underground Facilities. Submit a letter stating the case number.

B. Comply with the utility coordination requirements contained in the General Conditions.

1.06 PUBLIC/PRIVATE UTILITIES

A. Notify all public and private utilities in accordance with Article 20, Section 322-a of the New York State General Business Law for location and markout of existing utilities in the vicinity of the work.

B. Repair all utilities damaged during the Work to the standards and approval of the respective utility at no cost to the Owner.

1.07 CONTRACTOR'S JOB SITE SUPERINTENDENT

A. Each Contractor shall employ an on-site superintendent as specified herein below. He/She shall be a full-time employee of the Contractor.

B. Each Contractor shall name the job site superintendent within five (5) days of the Notice To Proceed. A letter to the Architect/Engineer shall be provided.

C. He/She shall have the authority to sequence and schedule the work, and to staff the project, so as not to interfere with the work by others and to complete the work daily within the time so required.

D. Each Superintendent shall have a minimum of five (5) years of experience as a job site superintendent for projects of equal size and complexity.

E. Each superintendent shall be qualified to perform the duties so required to successfully complete the work in accordance with the Contract Documents.

F. Each superintendent shall speak English. If required by the Architect/Engineer, provide a resume for the proposed superintendent that shall be typed and shall list the qualifications of the superintendent. Prior to the Contractor assigning a superintendent to the project, he may wish to arrange an interview with the Architect/Engineer to determine the proposed superintendent's ability to properly coordinate the work through the Owner/Architect/Engineer. The Contractor shall employ a superintendent acceptable to the Owner.

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REQUEST FOR INTERPRETATION/INFORMATION (RFI)

OWNER'S NAME: XYZ Corporation

PROJECT NAME & CONTRACT DESIGNATION: Fitness Center Redesign at Harrison High School

CONSTRUCTION CONTRACT NO.: HCSD2401E

Product, Item, or System:	
Request Date:	RFI No.:
Specification Section:	Paragraph Ref:
Contract Drawing Reference(s):	
Describe Request:	
Signed:	See Contractor's Attachments for Additional Description for Information
Owner/Architect/Engineer Response:	
Architect/Engineer (Printed):	See Architect/Engineer's Attachments for Additional Information
Architect/Engineer's Signature & Date	*Response Accepted By Contractor* *Contractor's Signature & Date*
The Work shall be carried out in accordance with these supplemental instructions without change in Contract amount or Contract time for completion. Prior to proceeding with these instructions, indicate your acceptance of these instructions by signing where indicated and returning this form to the Architect/Engineer.	

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work of this Section includes the requirements for progress meetings, including but not limited to, the following:
   1. Preconstruction conferences.
   2. Preinstallation conferences.
   3. Progress meetings.
   4. Coordination meetings.

1.02 PRE-CONSTRUCTION CONFERENCE

A. A preconstruction conference will be scheduled before starting construction, at a time convenient to the Owner, Owner's Construction Representative and the Architect, but no later than 15 days after issuance of the Letter of Intent. The conference will be held at the Project Site or another convenient location.

B. Attendees: Authorized representatives of the Construction Manager, Owner, Architect, and their consultants; the Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and be authorized to speak/make decisions, on behalf of the concern they represent, on matters relating to the Work.
   1. Agenda: Discuss items of significance that could affect progress, including the following:
   2. Tentative construction schedule.
   3. Critical work sequencing.
   4. Designation of responsible personnel.
   5. Procedures for processing field decisions and Change Orders.
   6. Procedures for processing Applications for Payment.
   7. Distribution of Contract Documents.
   8. Submittal of Shop Drawings, Product Data, and Samples.
   9. Preparation of record documents.
   10. Use of the premises.
   11. Parking availability.
   12. Office, work, and storage areas
   13. Equipment deliveries and priorities.
   14. Safety procedures.
   15. First aid.
   16. Security.
   17. Housekeeping.
   18. Working hours.

C. Reporting: The Owner's Construction Representative shall set-up the meeting(s), prepare and issue meeting minutes to attendees and interested parties.

1.03 PREINSTALLATION CONFERENCES

A. Contractor shall conduct a pre-installation conference at the Project Site before each construction activity that requires coordination with other construction activities / trade work.

B. Attendees: The Installer and representatives of the Prime Contractor, manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Owner's Construction Representative and Architect of scheduled meeting dates.

1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for the following:
   a. Contract Documents.
   b. Options.
   c. Related Change Orders.
   d. Purchases.
   e. Deliveries.
   f. Shop Drawings, Product Data, and quality-control samples.
   g. Review of mockups. Possible conflicts.
   h. Compatibility problems.
   i. Time schedules.
   j. Weather limitations.
   k. Manufacturer's recommendations.
   l. Warranty requirements. Compatibility of materials. Acceptability of substrates. Temporary facilities.
   m. Space and access limitations.
   n. Governing regulations. Safety.
   o. Inspecting and testing requirements. Required performance results.
   p. Recording requirements Protection.
2. Prime Contractor shall record significant discussions, agreements and disagreements of each conference and the approved schedule. Promptly distribute the record of the meeting to everyone concerned, including the Owner and the Architect.
3. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest possible date.
4. Reporting: Prime Contractor or Installer shall issue meeting minutes to attendees, Owner's Construction Representative, Owner and Architect and associated field representatives.

1.04 PROGRESS MEETINGS

A. Progress meetings will be held at the Project Site at regular intervals (typically weekly) as determined by the Owner's Construction Representative and Architect.

B. Attendees: In addition to representatives of the Owner, Owner's Construction Representative, and the Architect, each Prime Contractor shall be represented at these meetings. Attendance is mandatory at weekly meetings and contractor will include in their bid a sum of $250.00 per meeting (figure 10 meetings) to have an authorized individual in attendance capable of making decisions and providing direction. This amount will be listed as a separate line item on the

contractors Schedule of Values. If the contractor misses a meeting without prior written authorization from the Owner's Construction Representative, they will be issued a deduct change order in the amount of $250.00 per occurrence. Subcontractors, suppliers, or other entities will be invited at the discretion of the Owner, Owner's Construction Representative, and the Architect. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.
   1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to insure that current and subsequent activities will be completed within the Contract Time.
   2. Review the present and future needs of each entity present, including the following:
      a. Interface requirements. Time.
      b. Sequences.
      c. Status of submittals. Deliveries.
      d. Off-site fabrication problems. Access.
      e. Site utilization.
      f. Temporary facilities and services.
      g. Hours of work.
      h. Hazards and risks.
      i. Housekeeping.
      j. Quality and work standards. Change Orders.
      k. Documentation of information for payment requests.

D. Reporting: Approximately 5 days after each meeting, Owner's Construction Representative will prepare and distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

E. At least seven (7) calendar days advance notice will be given by the Owner's Construction Representative or the date for the upcoming meeting will be set during the progress meeting.

F. Attendance at progress meetings shall be mandatory. An amount of $1,000 shall be deducted from the Contract Amount for each announced meeting not attended by the Contractor.

G. The owner, a partner, or a corporate officer representing the Contractor shall attend each announced progress meeting. The job site superintendent and office project manager for each Contractor shall also attend.

H. Subcontractors shall attend when requested by the Owner or Owner's Construction Representative at no cost to the Owner.

I. Meetings will be conducted by Owner's Construction Representative at a location selected by the Owner, normally at or adjacent to the project site.

J. The minimum agenda will cover:

1. Review minutes of previous meetings.
2. Identify present problems and resolve them.
3. Plan work progress during next work period.
4. Review the status of off-site fabrication and delivery schedule.
5. Review shop drawings and submittal schedules.
6. Review change order status.
7. Review status of construction progress schedule.
8. Coordinate access requirements.
9. Other business related to the work.
10.

1.05 COORDINATION MEETINGS

A. Conduct project coordination meetings at regular intervals convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.

B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.

C. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

D. The Owner's Construction Representative Field Manager will conduct daily meetings with the prime contractors and major subcontractors foremen. The purpose of the meetings is to provide the opportunity for each contractor to communicate to the Field Manager any items relating to their respective construction activity for that day (request for shutdown, deliveries, etc.) The meetings will commence from 7:00 o’clock am until 7:30 o’clock am. These meetings are generally informal. The Owner's Construction Representative Field Manager will keep minutes of these meetings when appropriate and will be available upon request.

1.06 SAFETY MEETINGS

A. Each Contractor will be responsible to conduct their own safety meetings on a regular basis (but not less than four times during any thirty day period.)

B. Minutes of the Safety Meeting must be maintained by each contractor on-site and must be made available upon request. Failure to conduct and submit meeting minutes will be grounds to reject the Prime Contractor’s progress payment.

1.07 CONDUCTING MEETINGS

A. General - This paragraph covers Owner, Owner's Construction Representative, and Architect meetings with Contractor and/or his subcontractors. Neither the Owner nor the Owner's Construction Representative nor the Architect wish to meet solely with a subcontractor and

requests for such meetings will be discouraged. If a meeting is deemed necessary, every effort will be made to have Contractor attend. If, for some reason, circumstances do not allow such, the meeting may be held, minutes of the meeting will be sent to contractor and decisions on any major questions will be reserved until contractor has been consulted. Subcontractors may accompany contractor to meetings provided the contractor notifies the Owner's Construction Representative in advance.

B. Chairman - When Owner's Construction Representative/Owner attend meetings, the Owner's Construction Representative, or his duly authorized representative, will act as chairman. Should Owner-Contractor meetings be necessary, Owner will chair such meetings.

C. Notices - Owner's Construction Representative or Owner will issue notices of meetings to all parties concerned and will note, thereof, who must attend and who may attend if they so desire. When a Contractor desires a formal meeting, make a request through Owner's Construction Representative. Except when Owner's Construction Representative determines that a prompt meeting is essential, all notices will be issued at least one week in advance of the meeting date.

D. Agenda - All parties shall inform Owner's Construction Representative of items desired to be discussed and Owner's Construction Representative will notify all parties of all items to be considered. This is to allow each party to fully prepare for the meeting. This shall not be construed to mean that other items cannot be brought up at the meetings.

E. Time Limits - It is the intent to hold productive and efficient meetings and to keep them as short as is reasonably possible. The Chairman will be the sole judge as to whether or not further discussion on any matter is warranted and all discussions shall cease when he so orders.

F. Minutes - Minutes of meetings will be kept, written and distributed by the Chairman or his duly authorized representative. Minutes of all meetings will be available upon request to the Chairman.

G. Conduct - It is the intent to conduct all meetings in an orderly manner, to reasonably discuss all items and to hear and observe the rights and opinions of all parties. The Chairman will allow each party to speak, however, he reserves the right to order any individual to leave the meeting at any time for any reason.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies the requirements for preparing construction schedules and for keeping them up to date.

1.02 CONSTRUCTION SCHEDULE - GENERAL

A. The Contractor shall develop a full schedule, in sufficient detail and clarity of forand technique so that the contractor can plan and control his work properly and the Owner's Construction Representative, Owner, and Architect can each readily monitor and follow the progress for all portions of the work. The Contractor shall complete the detailed schedule within 10 days after contract award.

B. In no case shall first application for payment be approved prior to submission of acceptable preliminary schedule, detailed submittal schedule, and schedule of values.

C. Monthly updates, required schedules and graphics shall be submitted to the Owner's Construction Representative/Owner within five working days following the end of the preceding month. Monthly updates, schedules and graphics shall be submitted in five copies.

D. If any of the required submissions are returned to the Contractor for corrections or revisions, they shall be resubmitted within ten (10) calendar days after the return mailing date. Re-submittals shall be in the same quantities as noted above. Review and response by the Owner's Construction Representative/Owner will be given within (10) calendar days after resubmission.

E. The schedule shall comply with the various limits imposed by the scope of work any by any contractually intermediate milestone dates and completion dates included in the contract.

F. The activities identified in the schedule shall be analyzed in detail to determine activity time durations in units of whole working days. All durations listed shall be the result of definitive manpower and resource planning by the Contractor. The contractor will provide specific manpower loading information / crew size to support the duration proposed. (e.g. - 4 man crew can produce 1000 sq. ft. / day, project has 11,000 sq. ft., thus duration is identified as 11 days)

G. The activity data shall include activity codes to facilitate selection, sorting and preparation of summary reports and graphics. Activity codes shall be developed for:

1. Area: Subdivision of the site into logical modules or blocks and levels.
2. Responsibility: Contractor or subcontractor responsible for the work.
3. Specifications: CSI format - 48 Division.
4. System: Division of the work into building systems for summary purposes.
5. Milestone: Work associated with completion of interim completion dates or milestones.
6. Pay Item: Work identified with a pay item listed on the approved Schedule of Values.

H. Coordinate the work and maintain the construction schedule. In the event actual progress begins to lag the schedule, promptly employ additional means and methods of construction to make up the lost time.

I. Keep the construction schedule current and revise and resubmit as often as necessary to accurately reflect the conditions of the work, past progress and anticipated future progress.

J. The construction schedule shall be completed, submitted, and deemed received by the Architect/Engineer prior to the first payment application.

K. The schedule, when approved by the Owner's Construction Representative, Owner, and Architect, shall establish the dates for starting and completing work for the various portions of the Contract. It shall be the duty of the Contractor to conform to his/her own schedule and to perform the work within the time limits indicated. Failure to adhere to the approved schedule may expose the Contractor to disputes, claims and additional costs incurred by others.

L. Coordinate letting of subcontracts, material purchases, shop drawing submissions, delivery of materials, and sequence of operations, to conform to the schedule.

M. Coordinate the construction schedule with the proposed schedules of the equipment suppliers and subcontractors.

N. The schedule shall show the critical sequence items where new units must come online before existing facilities go offline, if applicable to the project. The schedule shall also show, in detail, the proposed sequence of the work and the estimated date of starting and completing each stage of the work in order to complete the project within the contract time.

O. The schedule shall be plotted out in color and shall be 11-inch by 17-inch. It shall contain as many sheets as are necessary to show all rolled down tasks. Partially printed schedules will not be accepted. Each Contractor shall arrange to have it plotted on a color plotter suitable for the intended application.

P. Prepare the schedule in a manner so that the actual progress of the work can be recorded and compared with the expected progress.

Q. The schedule shall use the following convention:

1. Tasks for the General Contractor in blue ink.
2. Task links/task dependency in blue ink.
3. Work by others in green ink.
4. Milestone dates (zero duration) by a red diamond.
5. The end date for each task and subtask at the end of a bar.
6. The description of all major tasks within the bar. The bar shall be red.
7. Critical path.

R. The construction schedule shall also show the following:

1. Critical sequence items where new units must come on-line before existing facilities go off-line, if applicable to the project.
2. Computer delivery, if so specified elsewhere.
3. Telephone service and high speed internet cable installation.

4. Lead time for control panels that are packaged as systems.

1.03 REPORTS

A. For initial submittal and each update the contractor shall prepare the following standard report:
   1. Tabular Schedule Report sorted by Activity code and Early Start.

1.04 GRAPHICS

A. For initial submittal the contractor shall prepare the following graphics:
   1. Pure logic diagram (Precedence Format) of all data, not time scaled, grouped by Activity code.
   2. Detailed bar chart sorted by Activity Code with Early Start and Early Finish.
   3. Summary bar chart summarizing by Activity Code with Early Start and Early Finish.

B. For each update the contractor shall prepare the following graphic:
   1. Bar Chart showing work activities with Early Start in the next 40 work-days sorted by Activity Code and Early Start.
   2. Summary Bar Chart summarizing by Activity Code showing progress with Early Start and Early Finish.

C. For each Change Order involving adjustment in the contract time for performance, the contractor shall prepare a pure logic diagram showing the changed work with all preceding (predecessors) and succeeding (successors)activities (fragnet schedule).

1.05 SUBMITTALS

A. In no case shall first application for payment be approved prior to submission of acceptable preliminary schedule, detailed submittal schedule, and schedule of values.

B. Monthly updates, required schedules and graphics shall be submitted to the Owner's Construction Representative and Owner within five working days following the end of the preceding month. Monthly updates, schedules and graphics shall be submitted in five copies.

C. If any of the required submissions are returned to the Contractor for corrections or revisions, they shall be resubmitted within ten (10) calendar days after the return mailing date. Resubmittal shall be in the same quantities as noted above. Review and response by the Owner's Construction Representative and Owner will be given within (10) calendar days after resubmission.

1.06 PAYMENT WITHHELD

A. If the Contractor fails to submit the required schedule information as indicated in this section within the time stipulated or provide revision(s) thereof within the requested time, the Owner and Owner's Construction Representative may withhold approval of Progress Payment Estimates until such time as the Contractor submits the required information.

1.07 REVISION OF PROJECT PROGRESS SCHEDULE

A. Each Prime Contractor shall evaluate and provide updated construction schedules monthly in accordance with job requirements. Each update shall be submitted to the Owner and Owner's

Construction Representative for information purposes and be provided by the last Friday of every month

B. Each Contractor shall modify its construction schedule to accommodate coordination of the construction contracts by the Owner/Architect/Engineer without claims for additional compensation or delay.

C. The Owner's Construction Representative will provide an electronic version of the Final Combined Construction Schedule for use in keeping the schedule up to date.

D. From time to time, and at stages deemed appropriate by the Owner's Construction Representative, the Owner may issue updated schedules to reflect the project's status. The percent complete for each task may be shown, as determined by the Owner's Construction Representative.

1.08 UPDATES

A. Updates of the Schedule shall be made at the end of each month reflecting actual or reasonably anticipated progress as of the last working day of the month. Monthly updates of the Detailed Schedule will be made each month until all work is substantially complete.

B. The Contractor will meet with the Owner's Construction Representative and Owner at the end of the updated period to review information in draft form before preparation of the required schedules and graphics. The Contractor will present data, prepared in advance, for review and approval of the Owner's Construction Representative and Owner including :

1. Actual Start Dates.
2. Actual Completion Dates.
3. Activity percent complete and/or Remaining Duration.
4. Revised logic, changes in activity duration's or resource assignments.
5. Narrative report discussing progress through the update period; changes, delays or other circumstances affecting progress; status of the project with respect to completion schedule; and any efforts by the Contractor to improve progress.

C. The update meeting will establish the values to be submitted for payment and will be directly related to the schedule of values in the application for payment.

D. The Contractor shall prepare a report of the meeting and make all changes, additions or corrections to the data resulting from the review. The contractor shall promptly prepare the monthly submittal following the update meeting.

1.09 CHANGES, DELAYS AND EXTENSIONS OF TIME

A. When changes or delays are experienced, the Contractor shall submit to the Owner's Construction Representative and Owner, a Time Impact Analysis (TIA) illustrating the influence of each change or delay on the currently scheduled Contract completion date. Each Time Impact Analysis shall include a Fragnet (network analysis) demonstrating how the Contractor proposes to incorporate the change or delay into the Detailed Schedule. Additionally, the analysis shall demonstrate the time impact based on the date the change was given to the Contractor, the status of construction

at that point in time, and the activity duration of all affected activities. The activity duration used in this Time Impact Analysis shall be those activities included in the latest update of the Detailed Schedule, closest to the time of delay or as adjusted by mutual agreement.

B. Each TIA shall be submitted within ten (10) calendar days after a delay occurs or a notice of change order is given to the Contractor. In cases where the Contractor does not submit a TIA for a specific change or delay with a specified period of time, it shall be mutually agreed that no time extension is required. Final evaluation of each TIA by the Owner's Construction Representative and Owner shall be made within fourteen (14) calendar days after receipt of the TIA unless subsequent meetings and negotiations are necessary. Adjustments in the Contract time for performance shall be made only by written change order approved by the Owner. Upon approval of the Owner, Fragnets illustrating the influence of changes and delays shall be incorporated into the Detailed Schedule by the contractor during the first update after agreement is reached.

C. The time difference between the Early Finish date and the Late Finish Date is defined as "float." The "float" belongs to the Project and may be used by the Contractor or the Owner's Construction Representative and Owner to benefit the Project. Changes or delays that influence activities in the network with "float" and do not extend the Critical Path (the network of activities with zero days "float") shall not be justification for an adjustment in Contract time for performance.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

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END OF SECTION 013223

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies the requirements for making submissions for the project. Electronic submissions will be required unless expressly noted otherwise.

B. Refer to Section 013216 - Construction Schedule for the requirements concerning the submission of construction schedules and for making updates thereto.

C. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:

1. Contractor’s construction schedule.
2. Submittal schedule.
3. Daily construction reports.
4. Shop Drawings.
5. Product Data.
6. Samples.
7. Quality assurance submittals.

D. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Permits.
2. Applications for Payment.
3. Performance and payment bonds.
4. Insurance certificates.
5. List of subcontractors.

E. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section " Payment Procedures" specifies requirements for submittal of the Schedule of Values.
2. Division 1 Section " Project Management and Coordination" specifies requirements governing preparation and submittal of required Coordination Drawings.
3. Division 1 Section "Project Meetings" specifies requirements for submittal and distribution of meeting and conference minutes.
4. Division 1 Section "Quality Requirements" specifies requirements for submittal of inspection and test reports.
5. Division 1 Section "Execution and Closeout Requirements " specifies requirements for submittal of Project Record Documents and warranties at project closeout.

1.02 DEFINITIONS

A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.

1. Preparation of Coordination Drawings is specified in Division 1 Section " Project Management and Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.

B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

C. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

1.03 IDENTIFICATION OF SUBMITTALS

A. Each and every submission shall be provided by the Contractor and shall be accompanied by a SUBMISSION TRANSMITTAL FORM. The Contractor shall use the specimen form made a part of this Section. *Submittals not containing the form will be returned to the Contractor un-reviewed.* The Architect/Engineer will not review project submissions until such time as the form is competed in its entirety. Identify each submittal and resubmittal using the form.

B. Each individual submittal shall be identified with a 'submission log number' as specified here in this example: 033000.01-1

1. The Section number for which the submittal applies, followed by a period, shall be indicated, "033000.".
2. The submittal within the Section shall be indicated by the next grouping "01". For instance and in this example, the concrete design mix may be submission "01", the waterstop catalog cut may be "02", and so on. Submittals shall be sequentially numbered within the Specification Section, i.e. 01, 02, etc.
3. The number of times the submission was made shall be preceded by a dash and a numerical suffix as follows: "-1". In this example, the concrete design mix is being submitted for the first time. Use the number "1" for the first time it is being submitted.
4. Subsequent submissions of the concrete design mix shall utilize the original number and a sequential numeric suffix, i.e. "2" for a resubmission, "3" for the second resubmission, and so on. Substitute the new number for the original "1".

C. Where a layout drawing, containing different elements of the project, is being submitted and there is a question as to what the log number might be, then the Contractor shall contact the Architect/Engineer so that an agreed upon log number can be assigned.

D. It is incumbent on the Contractor to initially assign the submission log number designation to each submission. Submissions not containing a log number, as specified above, will be returned to the Contractor un-reviewed by the Architect/Engineer.

E. Every submittal shall also be accompanied by a Transmittal Letter (or "Speed Form") addressed to the Architect/Engineer's Project Manager as hereinafter defined.

1.04 SUBMITTAL SCHEDULE

A. Submittals must be prepared and transmitted as follows, unless otherwise approved by the Owner's Construction Representative:

1. Within 15 working days after Notice to Proceed:
   a. Doors & Hardware.
   b. HVAC units.
   c. Ductwork shop drawings

d. Electrical fixtures and panels.
e. Asbestos Abatement submittals & Plan.

2. If the contractor misses the milestone submittal timeframes listed above, the owner / agents can withhold requisition payments until the required paperwork is received. If there are any open submittals beyond 60 days of contract award, the owner may withhold contractor payments until all required paperwork is received.
3. Upon approval by the Owner's Construction Representative, non-critical submissions may be transmitted after the above time frame.
4. Prepare submittals including information in accordance with Submittal Identification and Procedures specified in this section.

1.05 COORDINATION OF SUBMITTALS

A. Prior to submitting to the Owner's Construction Representative, fully coordinate all interrelated work. <> As a minimum, do the following:
   1. Determine and verify all field dimensions and conditions by field measuring existing conditions and the installed work of this Contract and work by others.
   2. Coordinate with all trades, subcontractors, vendors, system and equipment suppliers and manufacturers, public agencies, and utility companies and secure all necessary approvals, in writing.
B. Make submittals in groups containing all associated items that in some way depend upon each other.
   1. This also applies to color charts, as one color may not be able to be selected without the selection of other colors so as to form a color-coordinated group.
   2. The Owner's Construction Representative may elect not to review partial or incomplete submissions, whereupon he will notify the Contractor of the additional submissions that are required before a review can be made.

1.06 TIMING OF SUBMITTALS

A. Make submittals far enough in advance of scheduled dates of installation to provide time for reviews, for securing necessary approvals, for possible revisions and re-submittals, and for placing orders and securing delivery. The Architect/Engineer will review submittals in a manner as expedient as possible, and will generally send a written response to the Contractor within seven (7) calendar days of receipt of submittals.
B. Submissions may be returned reviewed, unreviewed, rejected, returned conditioned upon submission of related items, or for other reasons set forth in the Contract Documents.
C. Make submissions well in advance as the returning, rejecting or disapproval of submissions or other similar circumstances are possible and are deemed "avoidable delays". Costs for these delays or those attributed to Contractor’s tardiness in making submittals shall be borne by the Contractor.
D. ***All*** submittals requiring Owner's Construction Representative’s review (except operations manuals) as required under the technical specifications of these documents shall be submitted within **FORTY FIVE (45)** consecutive calendar days after the date of the Notice to Proceed. An amount of **$250** per calendar day shall be deducted from payment due the Contractor for ***each***

day that an outstanding submittal exists, said amount being the cost associated with the Owner's Construction Representative's review.

E. Operation and maintenance manuals shall be submitted at least **FORTY FIVE (45)** consecutive calendar days prior to scheduled startup of the unit or system.

F. If material or equipment is installed before it has been deemed to be in general compliance with the Contract Documents, as determined by the Owner's Construction Representative, the Contractor shall be liable for its removal and replacement at no extra charge and without an increase in contract time.

1.07 DESTINATION OF SUBMITTALS

A. Each submission of documents shall be accompanied by a transmittal form containing the name of the project, the contract name, the Architect/Engineer's project manager, a submittal ID number, and a description of content for the submitted items.

B. A copy of the TRANSMITTAL FORM shall also be provided to the Owner's Construction Representative's inspector at the job site.

C. Electronic submittals shall be transmitted through the Newforma® Project Center website; a Submittal Exchange website or by email; pending instruction by the Architect/Engineer. ABC Architect is using a project information application called Newforma® Project Center. One of its components is Newforma Info Exchange, a web application that facilitates sending and sharing transmittals, and file sharing.

D. As an external team member on this project the Contractor will be required to access the ABC Architect/Newforma Info Exchange website for information related to the project, including file transfers, RFI, Submittals, Action Items, and project Calendar information. The Contractor will have access to this website using any internet-capable computer running Internet Explorer or Firefox. All data transmitted through the ABC Architect/Newforma Info Exchange website is encrypted and logged. Further instructions will be provided to the Contractor after the contract is awarded.

E. Other submissions, such as material samples or other items as instructed by the Owner's Construction Representative, shall be sent to the Architect/Engineer's office as follows:

ABC Architect
Address, City, State Zip

Attention: H2M Project Manager (Named at Pre-Construction Conference or in the Notice to Proceed)

1.08 CLARITY OF SUBMITTALS

A. All printed materials shall be neat, clean, professionally drafted by hand or by computer, clear, legible, and of such quality that they can be easily reproduced by normal photocopying or wide format copy/print machines.

B. All electronic submittals shall be produced with a minimum resolution of 300 dpi.

C. Binders of information shall be separated into groups, subsystems, or similar equipment/function. Copies not conforming to this paragraph will be returned to the Contractor without the Owner's Construction Representative's review.

1.09 CONTRACTOR'S REPRESENTATION

A. By making a submission, the Contractor represents that he has determined and verified all field measurements and dimensions, field construction criteria, site and building constraints in terms of limitations in moving equipment into an enclosed space, materials, catalog and model numbers and similar data and that he has checked and coordinated each submission with other work at or adjacent to the project site in accordance with the requirements contained in Section 013100 - {\t\#1000103} and the Contract Documents.

B. Every SUBMISSION TRANSMITTAL FORM shall contain the Contractor's approval stamp and date showing that the submittal has been approved by the Contractor. The Owner's Construction Representative will not review submittals that have not yet been reviewed and approved by the Contractor.

1.10 ENGINEER/ARCHITECT'S REVIEW

A. Owner's Construction Representative will review and comment on each submission conforming to the requirements of this Section.

1. Architect/Engineer's review will be for conformance with the design concept of the project and will be confined to general arrangement and compliance with the Contract Documents only, and will not be for the purpose of checking dimensions, weights, clearances, fittings, laying lengths, tolerances, interference's, for coordinating the work by others or subcontractors.
2. The Architect/Engineer's review of a separate item, or portion of a system, does not represent a review of an assembly or system in which the item functions.

B. The Architect/Engineer will mark submittals as follows:

1. NO EXCEPTION TAKEN (**A**) - No corrections, no marks. The content of this submittal has been reviewed by the Architect/Engineer and been found to be in general compliance with the Contract Documents. No further submission of this submittal is required and the information contained in the submittal may be built into the work in accordance with the Contract Documents.
2. MAKE CORRECTIONS NOTED (**B**) - Minor amount of corrections. The content of this submittal has been reviewed by the Architect/Engineer and has been found in general to be in compliance with the Contract Documents. The notations made on the submittal by the Architect/Engineer shall be incorporated into the work in accordance with the terms and conditions of the Contract Documents. No further submission of this submittal is required.
3. AMEND AND RESUBMIT (**C**) - The content of this submittal has been reviewed by the Architect/Engineer and this review has determined that additional data and/or modification to the submitted data or other changes are required to bring the work represented in this submittal into compliance with the Contract Documents. This submittal shall be reviewed and revised in accordance with the Architect/Engineer's comments and resubmitted to the

Architect/Engineer for review. The information contained on the resubmittal shall not be incorporated into the work until the submittal is returned to the Contractor marked "NO EXCEPTION TAKEN" or "MAKE CORRECTIONS NOTED".

4. REJECTED (**D**) - The content of this submittal has been reviewed by the Architect/Engineer and has been determined not to be in accordance with the requirements contained in the Contract Document and requires too many corrections or other justifiable reason. The submittal shall be corrected and resubmitted or a submittal of an alternate shall be provided. No items are to be fabricated under this mark.
5. SUBMIT SPECIFIED ITEM (**E**) - The content of this submittal has been reviewed by the Architect/Engineer and this review has indicated that the work displayed in the submittal is not in compliance with the Contract Documents. The Contractor shall submit another submittal for this portion of the work, which complies with the Contract Documents.
6. RECEIVED (**R**) - This submittal is accepted on the project and filed for record purposes only, in accordance with the terms and conditions of the Contract Documents. Documents marked "RECEIVED" will not be returned.

C. No payment will be made on any item for which a submission is required if such submission:

1. has not been made,
2. has been made but was not stamped "No Exceptions Taken" by Architect/Engineer,
3. has been made and stamped "Make Corrections Noted", but contractor has not complied with Architect/Engineer's notes marked on the submittal,
4. has been made and stamped "No Exceptions Taken", but item provided does not conform to the shop drawing nor to the Contract Documents.

D. Submittals not required by these specifications will not be recognized or processed.

E. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for re-submittals.

1. Allow between 10 and 15 business days for initial review of the first round of submittals. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals.
2. If an intermediate submittal is necessary, process the same as the initial submittal. Allow an additional 10 business days for processing each submittal.
3. No extension of Contract Time will be authorized because of contractor's failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

1.11 RESUBMISSIONS

A. Prepare new and additional submissions, make required corrections, and resubmit corrected copies until found in compliance with the Contract Documents.

B. On, or with, re-submittals, clearly describe revisions and changes made, other than the corrections requested by Architect/Engineer, which did not appear on the previous submissions.

1.12 CONTRACTOR'S RESPONSIBILITIES

A. Architect/Engineer's review of submittals shall not relieve the Contractor of his/her responsibility for any deviation from the requirements of the Contract Documents nor relieve the Contractor from responsibility for errors or omissions in the submittals.

B. No portion of the work requiring a submission shall be commenced until the Architect/Engineer has found the submission in general compliance with the Contract Documents.

C. The Contractor shall provide written notification of any specification or drawing deviation.

1.13 EXCESS COSTS FOR ENGINEERING/ARCHITECTURAL SERVICES

A. The Owner will charge to the Contractor, and will deduct from the partial and final payments due the Contractor, all excess engineering and architectural expenses incurred by the Owner for extra services (work) conducted or undertaken by the Architect/Engineer as stipulated below:

1. Services and other similar charges because of the Contractor's errors, omissions, or failures to conform to the requirements of the Contract Documents as related to administrative charges associated with non-compliance with the requirements for making project submissions.
2. Services and other similar charges required to examine and evaluate any changes or alternates proposed by the Contractor and which may vary from the Contract Documents.
3. Services and other similar charges as a result of the Contractor's proposed substitution of materials, equipment or products which require a redesign of any portion of the project, as contained in the Contract Documents at the time of bid.
4. Services and other similar charges as a result of the Contractor's proposed substitution of products which require an engineering and/or architectural evaluation, beyond the time stipulated in Section 012500 - {\t\#1000053}, to determine if the substituted product is equal to that specified.
5. Services and other similar charges as a result of changes by the Contractor to dimensions, weights, sizes, voltages, phase, horsepower, materials of construction, and similar physical or operating characteristics of the product furnished which require redesign of the project in any way.
6. Services and other similar charges for the review of resubmissions of shop drawings that have been marked as "No Exceptions Taken" □or "Make Corrections Noted".
7. Services and other similar charges for the review of shop drawings submitted more than two (2) times for the same product or portion of the work.

1.14 MISCELLANEOUS SUBMITTALS

A. Provide a Submittal Schedule within seven (7) calendar days from the date of the Notice to Proceed. The Submittal Schedule shall list all submittals for the project referenced by draft log number. Provide the estimated date that the submittal will be transmitted to the Architect/Engineer for review.

B. Within seven (7) calendar days from the date of the Pre-Construction Meeting, submit a Proposed Products List. This list shall be a complete listing of all products proposed for use, with name of manufacturer, service headquarters, trade name and model number of each product. Partial listings will not be accepted.

C. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.15 SUBCONTRACTOR LIST

A. The Contractor shall submit, on AIA Form G705, within FIFTEEN (15) calendar days after the date of the Notice to Proceed, a list of all subcontractors, including the names of the major subcontractors that were submitted at the time of the bid.

B. Indicate M/WBE subcontractors in accordance with the requirements contained in other portions of the Project Manual.

1.16 MATERIAL SAFETY DATA SHEETS (MSDS)

A. Comply with "Right to Know" requirements of Chapter 551 of Laws of New York, 1980, concerning notification of the use of toxic substances.

B. Any product or substance used by the Contractor or its subcontractors which is listed in Subpart Z of OSHA Part 1910 Title 29 of the Code of Federal Regulations entitled "Toxic and Hazardous Substances" shall be identified to the Owner/Architect/Engineer by the Contractor's submission of a standard Material Safety Data Sheet (MSDS) in accordance with "Right To Know" requirements.

C. Products will not be permitted to be kept on site without a MSDS.

1.17 SHOP DRAWINGS

A. Submit shop drawings for all fabricated work, for all manufactured items and for items specifically required by the specifications.

B. Subcontractors shall submit shop drawings directly to the Contractor for checking. Thoroughly check subcontractors' shop drawings for measurements, sizes of members, details, materials, and conformance with the Contract Documents.

1. Return submittals which are found to be inaccurate or in error.
2. Do not submit to the Architect/Engineer until all corrections have been made.

C. Clearly show the relationship of the various parts of the project and where the information provided on the submission depends upon field measurements and existing conditions.

D. The Contractor shall make all measurements, confirm existing conditions, and include them on the shop drawings before making a submission to the Architect/Engineer.

E. Submissions for a single item, or group of related items shall be complete.

F. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

G. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

H. When submitting manufacturers' catalogs, pamphlets or other data sheets, in lieu of prepared shop drawings, clearly mark the items being submitted for review.

I. If the shop drawings contain any departures from the contract requirements, specifically describe them in the letter of transmittal.

1. Where such departures require revisions to layouts, structural, architectural, electrical, HVAC or any other changes to the work as shown, Contractor shall, at his own expense, prepare and submit revised drawings accordingly.
2. Make drawings the same size as the Contract Drawings and to the same scale.

J. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

K. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:

1. Dimensions.
2. Identification of products and materials included by sheet and detail number.
3. Compliance with specified standards.
4. Notation of coordination requirements.
5. Notation of dimensions established by field measurement.
6. Sheet Size: Except for templates, patterns and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 inches by 11 inches but no larger than 36 inches by 48 inches.
7. AII Technical Submittals.

1.18 SAMPLES

A. Where required, or where requested by the Architect/Engineer, submit sample or test specimens of materials to be used or offered for use.

1. Samples shall be representative, in all respects, of the material offered or intended, shall be supplied in such quantities and sizes as may be required for proper examination and tests, and shall be delivered to Architect/Engineer, prepaid, along with identification as to their sources and types of grades.
2. Submit samples well in advance of anticipated use to permit the making of tests or examinations.

B. Samples will be checked for conformance with the design and for compliance with the Contract Documents.

C. Work shall be in accordance with the approved sample. The use of materials or equipment for which samples are requested or required to be submitted is not permitted until such time that the Architect/Engineer has completed his review.

1.19 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Architect/Engineer.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation. Provide manufacturer's instructions with shop drawings.

1.20 CERTIFICATIONS

A. Submit certifications of compliance indicated in the Contract Documents.

B. Certifications shall be complete and exact, they shall be properly authenticated by the written signature, in ink, of an owner, officer or duly authorized representative of the person, firm or organization issuing such certification and they shall guarantee that the materials or equipment are in complete conformance with the requirements of these specifications.

1.21 COLORS AND PATTERNS

A. Unless the precise color and pattern are specified, whenever a choice of color or pattern is available in a specified product, submit accurate color and pattern charts for Architect/Engineer's and Owner's review and selection.

1.22 MANUFACTURER'S SERVICE CENTER

A. The product of a manufacturer who does not maintain an adequate nearby service center and a sufficient stock of spare parts are subject to rejection by Architect/Engineer solely on that basis.

B. With each submission, submit information on manufacturer's facilities and give complete details of his service policies and capabilities, and a general idea of the stock of spare parts available. Submit this information in the form of a certification. Also include names, addresses and telephone numbers of at least three of the service center's present customers who are in the area of the project.

1.23 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Distribution: It is the contractor's responsibility to coordinate submittals with each subcontracting trade. Each contractor shall be required to provide their subcontractors with a complete list of their submittals in order that other contractors can request required submittal information.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

1.24 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report recording the following information concerning events at the site, and submit one copy to the Architect and one copy to the Owner's Construction Representative by 10:00 a.m. the following day. Any contractor not submitting required reports will not receive approval ‹n the subsequent application for payment until such time that all required information is submitted

1. List of subcontractors at the site.
2. Count of personnel at the site (substantiates payroll).

3. High and low temperatures, general weather conditions.
4. Accidents and unusual events.
5. Meetings and significant decisions.
6. Stoppages, delays, shortages, and losses.
7. Meter readings and similar recordings.
8. Emergency procedures.
9. Orders and requests of governing authorities.
10. Change Orders received, implemented.
11. Services connected, disconnected.
12. Equipment or system tests and startups.
13. Partial Completions, occupancies.
14. Substantial Completions authorized.

1.25 TEST RESULTS AND INSTALLATION

A. Whenever field startup services are specified, the Contractor shall obtain from the manufacturer and submit to the Architect/Engineer Manufacturer Startup Reports (MSR's). The report shall detail the results of the field visit and all special conditions resulting from the startup.

B. Whenever field or factory tests are required on materials, equipment and systems, such tests shall be performed and the test results submitted to Architect/Engineer in the form of a MSR.

C. Do not deliver to the project or incorporate into the work any materials or equipment for which Architect/Engineer has not completed his review and found same to be in general conformance with the Contract Documents.

D. Submit MSR's within thirty (30) calendar days after the date of the startup or factory test.

1.26 SPARE PARTS LIST

A. Prepare a list of all spare parts specified to be provided in other Sections. Compile the total list for the purposes of reviewing actual spare parts delivered versus spare parts specified to be provided. The list shall reference the Section, model number, and quantity to be provided.

1.27 WAIVER OF CERTAIN SUBMITTAL REQUIREMENTS

A. Unless otherwise specified, the requirement to submit data and samples for products specified for approval will be waived for products specified by brand name if the specifically named products are furnished for the work. In such cases, the Contractor shall submit two (2) copies of required Product Data directly to the Architect/Engineer's field representative for information and verification during its incorporation into the work. The SUBMISSION TRANSMITTAL FORM shall always be used.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

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CONTRACTOR'S COMPANY NAME
ADDRESS

SUBMISSION TRANSMITTAL FORM

CLIENT NAME: XYZ Corporation

PROJECT TITLE: Fitness Center Redesign at Harrison High School

H2M PROJECT NO.: HCSD2401E

Product, Item, or System Submitted:			
Submission Date:		Submission Log No.:	
Specification Section:		Paragraph Reference:	
Contract Drawing Reference(s):			
Manufacturer's Name:			
Manufacturer's Mailing Address:			
Manufacturer's Contact Information:	*Name*	( ) *Tel. no.*	*Email*
Supplier's Name:			
Supplier's Mailing Address:			
Supplier's Contact Information:	*Name*	( ) *Tel. no.*	*Email*
This item is a substitution for the specified item:		____ No	____ Yes
		Contractor's Brief Comments or Remarks (attach separate letter as needed):	
Contractor's Approval Stamp with Signature & Date		By making this submission, we represent that we have determined and verified all field measurements and dimensions, field construction criteria, site and building constraints in terms of limitations in moving the item into the enclosed space, materials, catalog and model numbers and similar data and that we have checked and coordinated	

	this submission with other work at or adjacent to the installed location in accordance with the requirements contained in the Contract Documents.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Codes
B. Governing agencies
C. Permits

1.02 CODES

A. Comply with the requirements of the various codes referred to in these Specifications. Such codes shall be the date of the latest revision in effect at the time of receiving bids.
B. If there is a conflict between local, state, and/or Federal regulatory requirements, seek a consultation with the State Department of Labor. Resolve conflicts to the satisfaction of the State Department of Labor prior to commencing work.
C. Electrical Work: Conform to the requirements of the National Electrical Code (NEC) unless otherwise shown or specified. The Owner will be the sole judge of the interpretation of these rules and requirements.

1.03 GOVERNING AGENCIES

A. All work shall conform to and be performed in strict accordance with all governing agencies such as, but not limited to:
    1. Occupational Safety and Health Act - OSHA
    2. State Department of Environmental Conservation
    3. State Building Code
    4. State Fire Code
    5. National Fire Protection Association - NFPA
    6. National Electrical Code
    7. State Plumbing Code
    8. New York State Energy Code
    9. County Department of Health
    10. Town Codes, Rules, Laws and Ordinances
    11. Sewer District Sewer Use Code
    12. Local Water District
    13. Electric Utility
    14. Gas Utility
    15. State Education Department

1.04 PERMITS AND INSPECTIONS

A. Representatives of the Owner shall have access to the work for inspection purposes. The Contractor shall provide facilities suitable to the Owner to facilitate inspections of the installed work.
B. Obtain and pay for all permits, fees, licenses, certificates, inspections and other use charges required in connection with the work.

C. Obtain a New York Board of Fire Underwriters inspection and certificate.

D. The following permits and/or certifications will be obtained by the Owner from the appropriate permitting agencies:

1.

1.05 LISTINGS

A. Equipment and materials for which Underwriters' Laboratories, Inc. (UL) provides product listing service, shall be listed and bear the listing mark. Alternately, ETL Testing Laboratories, Inc. Product Safety Testing Listing is acceptable if the listed product has been tested to the applicable UL Standard.

1.06 FIRE RESISTANT CONSTRUCTION MATERIALS AND ASSEMBLIES

A. Conform to the fire rating classifications based upon the test methods and acceptance criteria in the Standard, Fire Tests of Building Construction and Materials for which Underwriters' Laboratories, Inc. (UL) provides listings.

B. Materials and assemblies shall comply with the acceptance criteria, detailed description of the assembly, its performance in the fire test and other pertinent details such as specification of materials, Classification coverage, and alternate assembly details.

C. Alternatively, fire resistance rating classifications by other issuing organizations listed in the Fire and Building Codes are acceptable.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 ABBREVIATED SUMMARY

A. This Section explains the format of the specifications.

1.02 SPECIFICATION FORMAT

A. The Specifications are generally arranged according to the Construction Specifications Institute (CSI) format. Most of the technical requirements are specified in the technical specifications of the document, which are grouped into forty-eight (48) major divisions. Most of the legal and administrative requirements are included in Division 01, General Conditions, Information For Bidders, and the Contract (agreement).

B. Technical sections are arranged in numerical order, however section numbers may not be consecutive from section to section.

C. Page numbering is subordinate to each section.

D. Most sections are generally broken down into three (3) parts:

1.	PART 1 - GENERAL
2.	PART 2 - PRODUCTS
3.	PART 3 - EXECUTION

E. Not all these parts may be used and in some cases, the title of some of the parts may be different than listed above. Paragraph numbers are subordinate to each part.

F. The Contractor is advised that the format described here is flexible in nature.

1. There is some overlapping of specified information between various portions of the Specifications.
2. In all cases, the entire requirements of the Contract Documents for the project shall apply.

G. Explanations:

1. Many technical sections begin with a paragraph titled "SECTION INCLUDES", "DESCRIPTION", or similar wording.
   a. In these paragraphs, a brief listing of the specified products may appear or a brief description of the work generally specified in that section is presented.
   b. These descriptions or listings are not all inclusive, but merely are provided as an aid in locating subject matter.
   c. In some cases special cost related items of work are called to the attention of the Contractor in these opening paragraphs.
2. "RELATED SECTIONS" or "RELATED WORK" or similar wording paragraphs list or reference related work specified elsewhere in the Contract Documents. Such listing is not all inclusive, rather, they are merely an aid to the Contractor in locating some of the other

Specification Sections wherein work is specified which has a particularly close interrelationship with the work specified in that section.

a. It shall be understood that all of the Work, and all of the Specifications and other portions of the Contract Documents, are interrelated, and that the total of all requirements set forth in all of the Contract Documents shall be met.
b. Equipment suppliers and manufacturers shall be advised of the requirements for making submittals and delivering products, as specified in Division 1 sections, even if said sections are not referenced therein that section.

3. "REGULATORY REQUIREMENTS" or "REFERENCES" or similar wording paragraphs describe standards, laws, guidelines, regulations, and standards related to workmanship and installation of the products specified which shall be followed by the Contractor in completing the work specified therein that section as if it was written there in that section. All such requirements and references shall be latest issue in effect at the time of the bid opening.
4. When a "GUARANTEE" or "WARRANTY" paragraph appears in the section it is calling attention to a guarantee which extends beyond the period of the Contractor's Guarantee called for in the administrative portion of the Contract Documents or it states special requirements specific to the equipment, systems or products specified in that section.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work of this Section includes the requirements for pre-installation meetings.

1.02 PRE-INSTALLATION MEETINGS

A. As required in individual specification sections, the Contractor shall convene a pre-installation meeting at the site prior to commencing work of the section.

B. Pre-installation meetings are to be convened at least one week prior to commencing work on the section. The contractor shall arrange and require attendance of Owner's Construction Representative, Owner, and Architect and parties directly affecting, or affected by, work of the specific section.

1. At least seven (7) calendar days advance notice is to be given.
2. The contractor shall prepare agenda and preside at meeting. At a minimum the following items are to be discussed:
3. Review conditions of installation, preparation and installation procedures.
4. Review coordination with related work.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Requirements for monitoring the quality of the constructed project.

B. Work of this Section also includes services of an independent testing laboratory for quality assurance testing.

1.02 REFERENCES

A. ASTM C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

B. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

C. ASTM D4561 - Practice for Quality Control Systems for an Inspection and Testing Agency for Bituminous Paving Materials.

D. ASTM E699 - Practice for Criteria for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee E6.

1.03 QUALITY ASSURANCE - CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or specified requirements indicate higher standards or workmanship that is more precise.

C. Perform work by persons qualified to produce workmanship of specified quality.

D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

E. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

1.04 MOCK-UP

A. Tests will be performed under provisions identified in this Section and identified in the respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashing, seals, and finishes.

C. Accepted mock-ups shall be a comparison standard for the remaining work.

D. Where a mock-up has been accepted by the Architect/Engineer and is specified to be removed, then the Contractor shall remove the mock-up and the clear area when directed to do so by the Architect/Engineer.

1.05 QUALITY ASSURANCE - TESTING LABORATORY

A. In order to establish compliance with the Contract Documents, materials shall be tested, examined and evaluated before they are incorporated into the work. During and after installations, additional tests, examinations, and evaluations shall be made to determine continued compliance throughout the course of the work.

B. Testing laboratory shall be a reputable, experienced firm that is capable of performing all of the required testing and authorized to operate in the state in which the project is located.

C. Perform all sampling and testing in accordance with specified procedures and use the materials, instruments, apparatus, and equipment required by the codes, regulations and standards. Where specific testing requirements or procedures are not described, perform the testing in accordance with all pertinent codes and regulations and with recognized standards for testing.

D. In the event that samples and test specimens are not properly taken, handled, stored or delivered or if other requirements of this Section are not complied with, Architect/Engineer reserves the right to delegate any or all of this work to others, or to take whatever action deemed necessary to ensure that sampling and testing are properly accomplished, for which all costs shall be borne by Contractor.

E. Architect/Engineer reserves the right to disapprove the use of a specific testing laboratory, even after prior approval, if the laboratory fails to meet or comply with the requirements of this Section. If this should occur, immediately discharge the testing laboratory and retain the services of a different laboratory acceptable to Architect/Engineer.

F. The testing laboratory shall meet the following criteria:

1. Be capable of performing all of the required tests.
2. Be regularly engaged in performing the types of services required.
3. Have adequate facilities, materials, equipment, and personnel to perform the services.
4. Have an adequately trained, experienced and qualified staff.
5. Have at least one registered professional engineer licensed in the state in which the project is located who shall be capable of performing field tests, supervising laboratory testing and interpreting test results. The professional engineer shall be thoroughly knowledgeable in materials, soils, asphalt paving and concrete.
6. Shall be able to be on the Project site within two hours after being notified.
7. Comply with the requirements of ASTM C1077, ASTM D3740, ASTM D4561, ASTM E548 and ASTM E699.
8. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

1.06 REFERENCE STANDARDS

A. Conform to reference standards by date that the project was last bid.

B. Obtain copies of standards when required by Contract Documents.

C. Should specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.07 SCHEDULING - LABORATORY SERVICES

A. Except where otherwise specified, the Architect/Engineer will determine the number of samples to be taken, the date and time samples will be taken and tests made, the number and type of tests to be performed, who will collect the samples, how they will be handled and stored and when laboratory personnel are required on site.

B. Architect/Engineer will notify Contractor of his/her decision to take samples and/or have tests made and provide him with the pertinent information. Contractor is responsible for notifying the testing laboratory and for having the testing performed, on schedule.

C. In addition to the above, Contractor shall make his/her own arrangements for the sampling and testing of materials he/she proposes to incorporate into the work. This shall not be paid for out of the cash allowance.

D. Notify Architect/Engineer at least 72 hours in advance of the times at which scheduled samples or tests will be conducted.

E. If samples and/or tests cannot be taken or performed when required, delay the work until such time that they can be accomplished. Where possible, any work that has been installed but has not been sampled or tested as required, shall be tested by other means. Upon Architect/Engineer's request, uncover any work, which has been buried or covered, and perform special tests designated by Architect/Engineer. If the work cannot be tested by other means, Architect/Engineer may declare the work unacceptable. All costs associated with noncompliance and for special testing shall be borne by the Contractor and not be paid for out of the cash allowance.

F. Should the testing laboratory be scheduled to take or collect samples or to perform tests, and finds that it is unable to do so as a result of delays in construction, inclement weather, or any other reason, reschedule the tasks for a date acceptable to Architect/Engineer. Costs associated with times testing laboratory is unable to perform scheduled services shall be borne by the Contractor and will not be paid for under the allowance.

G. Plan all work and operations to allow for the taking and collection of samples and allow adequate time for the performance of tests. Delay the progress of questionable work until the receipt of the certified test reports.

1.08 FIELD OBSERVATION OF CONTRACTOR'S WORK

A. The Architect/Engineer will provide periodic observation of the Contractor's work.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions. Verify that the existing substrate is capable of structural support or attachment of new Work being applied or attached. Examine and verify specific conditions described in individual specification sections. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance. Seal cracks or openings of substrate prior to applying next material or substance.

B. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 FIELD QUALITY CONTROL

A. Allow representatives of the testing laboratory access to the work at all time. Provide all equipment, labor, materials, and facilities required by the laboratory to properly perform its functions. Cooperate with and assist laboratory personnel during the performance of their work.

B. Test specimens and samples shall be taken by the person(s) designated in other Sections, or as directed by Architect/Engineer. Conduct field sampling and testing in the presence of Architect/Engineer. Provide all materials, equipment, facilities and labor for securing samples and test specimens and for performing all field-testing.

END OF SECTION 014500

NYS EDUCATION DEPARTMENT **OFFICE OF FACILITIES PLANNING** **ROOM 1060 EBA** **ALBANY, NY 12234**	**STATEMENT OF SPECIAL INSPECTIONS AND TESTS** **AS REQUIRED BY THE 2025 BUILDING CODE OF NEW YORK STATE**

BC NYS § 1704.3 requires the project Design Professional to complete the Statement of Special Inspections and Tests. Completion of the Statement of Special Inspections & Tests and submission to the Building Department with the Construction Permit Application is a condition for issuance of the Building Permit.

School District Building
XYZ Corporation ____

Project Title
HCSD2401E

SED Project #, Project Address
##-##-##-##-#-###-###, Project Location Address 1, Project Location City, New York, Project Location ZIP

Architect/Engineer
H2M Architects + Engineers, Inc.

Name of Person Completing this Statement Phone Date
Daniel Aiello, PE (631) 752-8000

Comments

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BC NYS)	**CONTINUOUS**	**PERIODIC**	**REFERENCE STANDARD**	**NYSBC REFERENCE**	**CHECK REQ'D**	**IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY**
A. Steel Construction				1705.2		
1. Structural Steel.	X	X	AISC 360 Chapter N.5	1705.2 1705.2.1		
2. Cold Formed steel deck.		X	SDI QA/QC 2011	1705.2 1705.2.3		
3a. Installation of open-web steel joist and joist girders		X	SJI specification (Section 2207.1)	1705.2 1705.2.3 1705.2.4 1705.2.5 1705.2.6		051200
B. Concrete Construction				1705.3 Table 1705.3		

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BC NYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	NYSBC REFERENCE	CHECK REQ'D	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
1. Inspection of reinforcing steel, including prestressing tendons, and placement.		X	ACI 318: Ch. 20, 25.2, 25.3, 26.6.1-26.6.3	1705.3 1908.4	**X**	033000
2a. Reinforcing Bar welding - Weldability of reinforcing bars other than ASTM A706.		X	AWS D1.4; ACI 318: 26.13.1.4	1705.3.1 Table 1705.3		
2b. Reinforcing bar welding-Single-pass fillet welds, maximum 5/16 inches.		X	AWS D1.4; ACI 318: 26.13.3	1705.3.1 Table 1705.3		033000
2c. Reinforcing bar welding - All other welds.	X		AWS D1.4; ACI 318: 26.13.3	1705.3.1 Table 1705.3		033000
3. Cast in concrete anchorage		X	ACI 318: 26.13.3.3	Table 1705.3	**X**	033000
4a. Post installed concrete members - Adhesive anchors installed horizontally or upwardly inclined to resist sustained tension loads.	X		ACI, 318:26.13.3.2	Table 1705.3		033000
4b. Post installed concrete members - Mechanical anchors and adhesive anchors not defined in 4a.		X	ACI 318:26.13.3.3	Table 1705.3	**X**	033000
5. Verify use of design mix.		X	ACI 318: Ch. 19, 26.4.3, 26.4.4	Table 1705.3, 1904.1, 1904.2,		
6. Sampling fresh concrete, slump, air content, temperature, strength test specimens.	X		ASTM C172, ASTM C31; ACI 318: 26.5, 26.12	Table 1705.3, 1908.10	**X**	033000
7. Inspect concrete and shotcrete placement for	X		ACI 318: 26.5	Table 1705.3 1908.6	**X**	033000

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BC NYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	NYSBC REFERENCE	CHECK REQ'D	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
proper application techniques.				1908.7 1908.8		
8. Inspection for maintenance of specified curing temperature and techniques.		X	ACI 318: 26.5.3-26.5.5	Table 1705.3, 1908.9	X	
9A. Inspection of prestressed concrete for - Application of Prestressing Forces	X		ACI 318: 26.10.	Table 1705.3		
9B Inspection of prestressed concrete for - Grouting of bonded prestressing tendons	X		ACI 318: Ch. 26.10	Table 1705.3		
10. Inspect erection of precast concrete members		X	ACI 318: 26.9	Table 1705.3		
11. Verification of in-situ concrete strength prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and slabs.		X	ACI 318: 26.11.2	Table 1705.3	**X**	033000
12. Inspect formwork for shape, location and dimensions of the concrete member being formed		X	ACI 318; 26.11.1.2(b).	Table 1705.3		
C. Masonry Construction						
1. Masonry construction	X		ACI 530 /ASCE 5/ TMS 402 and ACI 530.1 /	1705.4	**X**	042201

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BC NYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	NYSBC REFERENCE	CHECK REQ'D	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
			ASCE 6 / TMS 602 Ch.3			
2. Empirically designed masonry, glass unit masonry and masonry veneer in Risk Category IV.		X	TMS 402 / ACI 530 / ASCE 5 Level B Ch. 3	1705.4.1 2109 2110 or Ch. 14		
3. Vertical masonry foundation elements		X		1705.4 1705.4.2		
D. Wood Construction				1705.5		
1. Wood construction - Fabrication of wood structural elements and assemblies.		X		1705.5, 1704.2.5		
2. High-load Diaphragms.		X		1705.5 1705.5.1 2306.2 1704.2		
3. Metal-plate-connected wood trusses spanning 60 feet or greater (temp. and permanent installations)		X		1705.5.2		
4. Inspection of anchorage and connections of mass timber construction to timber deep foundation systems		X		1705.5.3		
5. Inspect erection of mass timber construction		X		1705.5.3		

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BC NYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	NYSBC REFERENCE	CHECK REQ'D	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
6. Inspection of connections where installation methods are required to meet design loads				1705.5.3		
6a. verify use of proper installation equipment for threaded fasteners		X		1705.5.3		
6b.Verify use of pre-drilled holes where required		X		1705.5.3		
6c. inspect screws, including diameter, length, head type, spacing, installation angle and depth.		X				
6d. adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads.	x					
6e. adhesive anchors not defined in cell above		X				
6f. bolted connections		X				
6g. concealed connections		x				
E. Soils				1705.6		
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity		X		1705.6 Table 1705.6	**X**	312323.13
2. Verify excavations are extended to proper depth and have reached proper material		X		Table 1705.6	**X**	312323.13

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BC NYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	NYSBC REFERENCE	CHECK REQ'D	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
3. Perform classification and testing of compacted fill materials		X		Table 1705.6	**X**	312323.13
4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill	X			Table 1705.6		
5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.		X		Table 705.6		
F. Driven Deep Foundations				1705.7		
1. Verify element materials, sizes and lengths comply with the requirements	X			1705.7 Table 1705.7		
2. Determine capacities of test elements and conduct additional load tests, as required.	X			1705.7 Table 1705.7		
3. Inspect driving operations and maintain complete and accurate records for each element.	X			1705.7 Table 1705.7		
4. Verify placement, locations, and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record	X			1705.7 Table 1705.7		

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BC NYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	NYSBC REFERENCE	CHECK REQ'D	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
tip and butt elevations and document any damage to foundation element.						
5. For steel elements, perform additional special inspections in accordance with Section 1705.2.	X			1705.2 Table 1705.7		
6. For concrete elements and concrete-filled elements, perform tests and additional special inspections in accordance with Section 1705.3.	X			1705.3 Table 1705.7		
7. For specialty elements, perform additional inspections as determined by the registered design professional responsible in charge	X			1705.7 Table 1705.7		
G. Cast-In-Place Deep Foundations				1705.8		
1. Inspect drilling operations and maintain complete and accurate records for each element	X			1705.8 Table 1705.8		
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end bearing	X			1705.8 Table 1705.8		

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BC NYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	NYSBC REFERENCE	CHECK REQ'D	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
strata capacity. Record concrete or grout volumes.						
3. For concrete elements, perform tests and additional special inspections in accordance with Section 1705.3				1705.3 Table 1705.8		
H. Helical Pile Foundations	X			1705.9		
1. Installation and load tests (if applicable)				1705.9	**X**	316615

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BC NYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	NYSBC REFERENCE	CHECK REQ'D	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
I. Fabricated Items		X		1705.11 1704.2.5		
J. Wind Resistance				1705.12		
1. Applicable in Exposure Category B with a basic wind speed of 120 mph and Exposure Categories C or D with basic wind speed of 110 mph or greater.		X		1705.12	**X**	
1a. Structural wood - Field gluing operation of elements of main wind force-resisting system	X			1705.12.1		

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BC NYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	NYSBC REFERENCE	CHECK REQ'D	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
(MWRS).						
1b. Structural wood - Nailing, bolting, anchoring, and fastening elements of the MWRS.		X		1705.12.1	**X**	061000
2a. Cold formed steel - Welding operations of elements of MWRS.		X		1705.11.2		
2b. Cold formed steel - Screw attachments, bolting, anchoring, and fastening of elements of MWRS.		X		1705.12.2		
3. Wind-resisting components - Roof covering, roof deck, and roof framing connections. Exterior wall covering and wall connections to roof and floor diaphragms and framing.		X		1705.12.3	**X**	061000 073113
K. Special Inspections for Seismic Resistance: Applicable to specific structures, systems, and components.				1705.13		
1. Structural steel - Seismic force-resisting systems & elements.	X		AISC 341 Chapter J	1705.13.1.1 or 1705.13.1.2		
2a. Structural wood - Field gluing operation of elements of seismic force-resisting system (SFRS).	X			1705.13.2		
2b. Structural wood - Nailing, bolting, anchoring, and fastening of elements of SFRS.		X		1705.13.2		

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BC NYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	NYSBC REFERENCE	CHECK REQ'D	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
3. Cold-formed steel framing - welding and fasteners.		X		1705.13.3		
4. Designated seismic systems - verify that label, anchorage, and mounting conforms to the certificate of compliance.		X	ASCE 7 Section 13.2.2	1705.13.4		
5. Architectural components.		X		1705.13.5		
6. Plumbing, Mechanical and Electrical components.		X		1705.13.6		
7. Access floors		X		1705.13.5.1		
8. Storage racks		X		1705.13.7 Table 1705.13.7		
9. Seismic isolation systems.		X		1705.13.8		
10. Cold-formed steel special bolted moment frames.		X		1705.13.9		
L. Structural Testing for Seismic Resistance: Applicable to specific structures, systems, and components.				1705.14		
1. Structural steel.	X	X	AISC 341 Chapter J	1705.14.1 1705.14.1.2		
2. Nonstructural components.		X	ASCE 7 Section 13.2.1	1705.14.2		
3. Designated seismic systems.		X	ASCE 7 Section 13.2.2	1705.14.3		
4. Seismic isolation systems		X	ASCE 7 Section 17.8	1705.14.4		

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BC NYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	NYSBC REFERENCE	CHECK REQ'D	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
M. Sprayed Fire-Resistant Materials				1705.15		
1. Physical and visual tests. Applicable to specific structures.		X		1705.15.1		
2. Structural member surface conditions		X		1705.15.2		
3. Application.		X		1705.15.3		
4. Thickness.		X	ASTM E 605	1705.15.4		
5. Density.		X	ASTM E 605	1705.15.5		
6. Bond strength.		X	ASTM E 736	1705.15.6		
N. Mastic and Intumescent Fire-Resistant Coatings [BF].		X	AWCI 12-B	1705.16		
O. Exterior Insulation and Finish Systems (EIFS).		X	ASTM E 2570	1705.17		
P. Fire-Resistant Penetrations and Joints [BF] High rise building or buildings assigned to Risk Category III or IV.		X	ASTM E 2174 ASTM E 2393	1705.18		
Q. Testing for Smoke Control		X		1705.19 1705.19.1 1705.19.2		
R. Sealing of Mass Timber		X		1705.2		

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Asbestos and lead-based paint certification.

B. Moisture control.

1.02 ASBESTOS AND LEAD-BASED PAINT CERTIFICATION

A. Contractor shall submit the enclosed "Asbestos and Lead-Based Paint Certification" upon completion of all work.

1.03 MOISTURE CONTROL

A. The Contractor shall maintain a strict policy and protocol for the control of water infiltration and moisture build-up during the course of the project. The plans and specifications are not intended to depict each and every condition or detail of construction. As the knowledgeable party in the field, the Contractor is in the best position to verify that all construction is completed in a manner which will provide a watertight structure. The Contractor has the sole responsibility for ensuring the watertight integrity of the structure. The Contractor's contractual obligations include, but are not limited, to the following:

B. Water Infiltration: If the Contractor observes water infiltration (unintended) into a completed building or an ongoing construction site, he must immediately report the condition to the Owner and Architect/Engineer, and shall immediately take steps to investigate the source of the water infiltration, identify the responsible party (person who performed work that resulted in water infiltration) and devise a procedure to promptly eliminate water infiltration into the building.

C. Handling of Water-Damaged Building Materials and Construction:

1. Contractor shall inspect all building materials delivered to the site for pre-existing water damage, as well as existing mold growth.
2. If in-place construction becomes wet, notify the Owner and Architect/Engineer immediately. The Owner and Architect/Engineer will determine whether or not the work shall be removed and replaced, or if the type of material can be permitted to dry.
3. Under no circumstances may new or additional construction be placed over, or otherwise enclose, wet building materials.

D. Visible Mold/Mildew:

1. If the Contractor observes any substance that appears to be mold or other fungal growth and/or an unidentified substance within a completed building or the ongoing construction site, he shall immediately suspend construction operations in the area, and report the condition to the Owner and Architect/Engineer.
2. No person shall be allowed back into the affected area without permission of the Owner.

1.04 SUBMITTALS

A. Contractor shall submit completed and notarized "Certification of Asbestos and Lead-Based Paint" form.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

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Certificate of Asbestos and Lead-Based Paint (New Work)	
Client's Name:_____	
Project Location:_____	
Project Address:_____	
Project Name:_____	
Project Number:_____	
CERTIFICATION:	
This Contractor hereby certifies that no asbestos-containing material and lead-based paint, as defined by applicable federal and state regulations, has been furnished or installed at the referenced project:	
Contractor Name:_____	
Signature:_____	
Address:_____ _____	
Telephone:_____	Date Executed: _____
This Form Shall Be Notarized	

END OF SECTION 014536

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PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

B. Temporary utilities include, but are not limited to, the following:

1. Drainage.
2. Water Service and distribution.
3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
4. Ventilation.
5. Electric power service.
6. Lighting.
7. Temporary Heating.

C. Support facilities include, but are not limited to, the following:

1. Waste disposal facilities.
2. Field offices.
3. Storage and fabrication sheds.
4. Lifts and hoists.
5. Staging areas.
6. Construction aids and miscellaneous services and facilities.
7. Scaffolding and platforms

D. Security and protection facilities include, but are not limited to, the following:

1. Environmental protection.
2. Stormwater control.
3. Tree and plant protection.
4. Pest Control.
5. Site enclosure fence.
6. Security enclosure and lockup.
7. Barricades, warning signs, and lights.
8. Covered walkways
9. Temporary enclosures.
10. Temporary partitions.
11. Fire protection.

E. Unless work of this section is indicated to be provided under a specific contract, Contractor must provide, maintain and remove required temporary facilities necessary to perform his own construction activities.

F. Accessible Temporary Egress: Comply with applicable provisions in ICC A117.1.

1.02 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:

1. Building code requirements.
2. Health and safety regulations.
3. Utility company regulations.

4. Police, fire department, and rescue squad rules.
5. Environmental protection regulations.

B. Standards: Comply with NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations,” ANSI A10 Series standards for "Safety Requirements for Construction and Demolition,” and NECA Electrical Design Library "Temporary Electrical Facilities.”

1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 “National Electric Code."

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.03 PROJECT CONDITIONS

A. Temporary Utilities: Each contractor will prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-preventive measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

1.04 DIVISION OF RESPONSIBILITIES

A. General: These Specifications assign the Contractor responsibilities.

B. Each Contractor is responsible for the following:

1. Installation, operation, maintenance and removal of each temporary facility considered as its own normal construction activity, as well as the costs and use charges except as listed below.
2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
3. Its own storage and fabrication sheds.
4. Hoisting requirements, including hoisting loads in excess of 2 tons, hoisting material or equipment into spaces below grade, and hoisting requirements outside the building enclosure. (Rigging Insurance must be provided by each prime contractor)
5. Collection and disposal of its own hazardous, dangerous, unsanitary, or other harmful waste material.
6. Secure lock-up of its own tools, materials and equipment.
7. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.
8. Maintaining temporary facilities provided by Contractor.
9. Complying with the regulations of the Commissioner of Education - 8 NYCRR 155.5 - Uniform Safety Standards for School Construction and Maintenance Projects specified in Division 1 Section 011400.
10. Containers for non-hazardous waste and debris generated by their own demolition and construction operations.

1.05 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to Owner, Architect or Owner's Construction Representative and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
   1. The Owner's Construction Representative.
   2. Other Contractors.
   3. Owners construction forces.
   4. Occupants of Project.
   5. Architect .
   6. Testing Agencies.
   7. Personnel of authorities having jurisdiction.

B. Water Service: Use water from the Owner’s existing water system without metering and without payment of use charges. Access to water shall be approved by the Owner.

C. Electric Power Service: Temporary electric power including set-up and maintenance is the responsibility of the Electrical Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Provide new materials. If acceptable to the Architect / Construction Manager, the Contractor may use undamaged, previously used materials in serviceable condition. P ovide materials suitable for use intended.

B. Lumber and Plywood:
   1. For job-built temporary offices, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.
   2. For signs and directory boards: provide exterior grade APA HDO plywood of sizes and thicknesses indicated.
   3. For vision barriers, provide minimum 3/8-inch-thick exterior plywood.
   4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch-thick exterior plywood over appropriate wood framing.

C. Paint:
   1. Paint surfaces exposed to view from Owner occupied areas in a color selected by the Owner's Construction Representative. Maintain coverage throughout the construction period.

D. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.

E. Water: Provide potable water approved by local health authorities. Protect water sources with approved backflow or vacuum breaker devices.

F. Open-Mesh Chain Link Fencing: Provide 0.120-inch-thick, galvanized steel posts, and 2.875" diameter. Gate posts with 6 foot high mesh on stanchion posts spaced 8-foot on center maximum. Provide lockable gates with galvanized chains and security padlocks. Furnish keys to the Owner, Owner's Construction Representative, Prime Contractor represesentatives, and nescessary construction personnel.

G. Temporary Roofing: 5/8" FR plywood roof sheathing and 45 mil reinforced EPDM membrane

H. Temporary Flooring protection : " Ram Board" or equivalent with taped joints.

2.02 EQUIPMENT

A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water Hoses: Provide 3/4-inch, heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge and vacuum breakers at hose bib connections .

C. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the potential exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.01 CONTRACTOR FIELD OFFICES

A. Contractors may, with permission from the Owner and Owner's Construction Representative, establish a field office for their own use. Offices for the individual prime contractors, sub-contractors, specialty contractors and the like shall be of size and design as approved by the Owner and Owner's Construction Manager. Offices shall be located in the designated staging area. Each representative contractor shall arrange for telephone service and electric service, if required, directly with the utility company. (No field offices or storage trailers will be allowed within 100 feet of any building.)

B. Maintain, in the each contractor’s field office, all articles for First Aid treatment. Each contractor shall also establish standing arrangements for the immediate removal and hospital treatment of any employees and other persons on the job site who may be injured or who may become ill during the course work.

3.02 TEMPORARY AND PERMANENT SERVICES, GENERAL

A. The Contractor's use of any permanent system or service of the building or portions thereof shall be subject to the Owners approval.

B. The Contractor shall be responsible for any and all damage to permanent services used, and shall make good any and all damage to the satisfaction of the owner, prior to final completion and acceptance.

C. NOTE - In accordance with OSHA and other applicable regulations, the representative Contractors performing erection of "skeleton" type work are solely responsible for the netting, guard rail protection and such other safety devices as deemed necessary to protect the workers and public from harm.

3.03 TEMPORARY LIGHT AND POWER

A. Temporary Electric Power Service: Electrical Contractor shall provide and pay all costs to provide a weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics to accommodate performance of work during the construction period.

1. Responsibility: All work under this section to be provided by the Electrical Contractor.
2. Applicability: This section applies to all renovation and new construction work areas for this Project.
3. Electrical Contractor shall make arrangements with utility company for temporary and permanent services immediately after award of contract.
4. Temporary or permanent services for temporarily or permanently installed building equipment such as sump pumps, boilers, cabinet heating and/ or cooling units and fans shall be furnished, installed, operated and maintained so that the said equipment may be operated for drainage and temporary heat when required and/ or when so ordered by the Architect and Owner's Construction Representative.
5. Electrical Contractor shall maintain all parts of the electrical system (temporary and permanent) active and in-service at all times throughout the contract duration. All temporary lighting to be controlled by standard switches per code (outside of power panels).
6. Electrical contractor shall provide temporary generator power to maintain power to critical circuits during main electric service switch over. Critical circuits shall include fire alarm, emergency lighting, communication, information technology, heating units, etc. Coordinate required circuits with owner. Contractor shall assume a minimum of (2) 50 kw generators and temporary panels as necessary. Generators shall be located at the building exterior. Provide feeder cables, adequately sized, in accordance with NEC to feed temporary panels or existing sub-panels. Contractor shall include required fuel for operation.
7. Electrical Contractor shall maintain power during the hours established by Owner's Construction Representative.
8. Temporary Service: Install service and grounding in compliance with the National Electric Code (NFPA 70). Include necessary meters, transformers, overload protected disconnect and main distribution switch gear. Comply with all NECA, NEMA and UL Standards
9. Provide temporary service with an automatic ground-fault interrupter feature, activated from the circuits of the system.

10. Power Distribution System: Provide circuits of adequate size and proper characteristics for each use. In general run wiring overhead. Rise vertically where wiring will be least exposed to damage from construction operations.
11. Provide metal conduit, tubing or armored cable for protection of temporary power wiring where exposed to possible damage during construction operations. Where permitted by code, wiring of circuits not exceeding 110-120 Volt 20 Amp rating and wiring of lighting circuits may be non- metallic sheathed cable in areas where located overhead and exposed. Do not wire temporary lighting with plain, exposed (insulated) electrical conductors. Provide metal enclosures or boxes for wiring devices.
12. Provide overload-protected disconnect switch as required by code.
13. For power hand tools and task lighting, provide temporary 4-gang outlets at each floor level, spaced so that a 50-foot extension cord can reach each work area. Provide separate 110-120 Volt, 20 Amp circuit for each 4-gang outlet (4 outlets per circuit).
14. Temporary electric power for Owner's Representative's field office.
15. Temporary power and lighting for any sidewalk bridges.
16. Maintaining all existing systems, including but not limited to, power, lighting, fire alarm, intercom, kitchen freezers and refrigerators, etc., within the existing building operational at all times for Owner occupancy and construction.

B. TEMPORARY ELECTRICAL AND TELEPHONE SERVICES

1. Temporary Power Source: At each building / renovation area, use the existing electrical power distribution system for temporary power source.
2. Owner's Requirements: Do not disrupt the Owner's needs for continuous power at each building.
3. Electrical Contractor shall provide temporary power and lighting facilities for use of all trades. All temporary light and power shall be in accordance with the required Codes and Safety Standards. The temporary light and power shall be used until permanent light and power is completed or portions of the building(s) are enclosed.
4. Owner's Construction Representative on-site trailer already has power and data/tel wiring
5. All other contractor trailer use / connection charges for power and telephone to be paid by the respective contractor.

C. TEMPORARY POWER DISTRIBUTION

1. General Requirements: Electrical Contractor shall provide feeders and branch circuits of adequate size and proper characteristics as required to supply temporary receptacle and lighting loads. Size service and feeder conductors to restrict voltage drop to maximum 5 percent at 80 percent power factor. Provide properly sized overcurrent protection for each temporary electrical circuit.

D. RECEPTACLE REQUIREMENTS

1. General Requirements: Provide temporary receptacle outlets as required for operation of portable tools and appliances during the construction period.
2. Minimum Requirements: Provide a minimum of one quad 120 volt receptacle per 2500 square feet of building floor area, with maximum spacing of 50 feet on center.
3. Branch Circuits: All temporary receptacle branch circuits to be rated 20 amps with a maximum of (3) duplex receptacles per circuit. Temporary receptacle branch circuits shall be independent of temporary lighting circuits.

E. LIGHTING REQUIREMENTS

1. General Requirements: Electrical Contractor shall provide both interior and exterior lighting at areas where existing lighting has been removed and at new construction areas, as

required to provide adequate illumination for safe and proper construction operations and Project Site security.

2. Minimum Requirements: Provide illumination levels adequate for construction operations and safe traffic conditions. As a minimum provide one 200 watt lamp per 400 square feet of building floor area, with maximum spacing of 20 feet. Any rooms in excess of 500 sf will receive one 400 watt metal halide fixture for each 1000 sq. ft. of area.
3. Stairways: Provide one 200 watt lamp per landing at each stairway.
4. Barricades: Provide adequate lighting for personnel safety at barricades, ladders, openings and other similar locations.
5. Supplemental Lighting: If required, supplemental lighting beyond minimum requirements shall be provided via suitable portable lighting units with cord and plugs, and shall be paid for by the Contractor or Sub-Contractor requiring such additional lighting.
6. Branch Circuits: All temporary lighting branch circuits to be loaded to a maximum of 1400 watts per 20 amp circuit. Temporary lighting branch circuits shall be independent of temporary receptacle circuits.
7. Restrictions: Do not use permanent lighting systems for temporary construction lighting purposes.

F. MAXIMUM LOADS

1. General: Lighting and power loads connected to the temporary power distribution system shall be limited to the following maximum individual loads:

	Load Type	Maximum
a.	120 V, 1 Phase	1.5 KVA
b.	208 V, 1 Phase	2.5 KVA
c.	208 V, 3 Phase	5.0 KVA

2. General: The temporary power distribution system shall be sufficiently sized to provide temporary power as required within this section. Meter and Meter connections to be part of electrical contractors base bid.

G. ELECTRICAL WELDERS

1. Separate Power Sources Required: Power for electric welders and for other loads larger than the maximum allowable sizes shall be taken from portable power sources provided, paid for and operated by the Contractor or Sub-Contractor requiring the use of such equipment. Remove such power sources when no longer needed.

H. ELECTRICAL ENERGY COSTS

1. Paid By Owner: Charges for electrical energy usage for temporary power and lighting will be paid by the Owner, when taken from the Owner’s electrical services. Contractor and Sub-Contractors shall exercise measures to conserve energy usage. Use of Owner supplied electric for items not specific to project (e.g. heating construction shanties, etc.) will not be permitted.

I. USE CHARGES

1. General: Cost or use charges for temporary facilities are not chargeable to the Owner or the Architect, Engineer, or Owner's Construction Representative. The Architect and Owner will not accept a prime contractor’s cost or use charges for temporary services or facilities as a basis of claim for an adjustment in the Contract Sum or the Contract Time.
   a. Water Service Use Charges: Water from the Owner’s existing water system may be used without metering, and without payment for use charges.

b. Electric Power Service Use Charges: Electric power from the Owner's existing system may be used without payment of use charge

3.04 TEMPORARY TOILET FACILITIES

A. Sanitary Facilities: Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with governing regulations including safety and health codes for the type, number, location, operation and maintenance of fixtures and facilities; provide not less than specified requirements. Install in locations which will best serve the project’s needs. Owner's existing facilities shall not be used.

B. Responsibilities: The General Construction Contractor is responsible for temporary sanitary facilities and their maintenance, cleaning and supplies for use by all trades. Sufficient quantity/locations to properly handle the amount of workers on-site.

C. Supply and maintain toilet tissue, paper towels, paper cups and other disposable materials as appropriate for each facility, including Owner's Construction Representative temporary offices for full contract duration. Provide covered waste containers for used material.

D. Install self-contained toilets to the extent permitted by governing regulations.

E. Provide separate toilet facilities for male and female construction personnel.

F. Provide separate toilet facilities for Owner's Construction Representative located at _____ at the direction of Owner's Construction Representative.

3.05 TEMPORARY HEATING

A. The Mechanical Contractor will maintain 60 degree temperature in all areas via temporary and/or permanent systems. The Mechanical Contractor will submit a detailed plan including sketches indicating his proposed temporary heating system for engineer approval within 1 week of contract award. The Electrical Contractor will provide permanent or temporary power for the Mechanical Contractor's units for temporary heating. General Work Contractor will insure all windows / doors and work areas are fully enclosed. (Any missing components at time of temporary heat activation will be enclosed via 5/8 inch thick plywood, 2” rigid polyisocyanurate and 6-mil fire-retardant polyethylene sheeting for a weather-tight insulated enclosure.)

B. The fuel, equipment, materials, operating personnel and methods used therefore shall be at all times satisfactory to the Architect and Owner's Construction Representative and adequate for the purpose intended. The use of electric heaters is not acceptable. All required fuel is part of this contract.

C. The Contractor shall maintain the critical installation temperatures provided in the technical provisions of the specifications herein for all work in those areas where same is being performed.

D. The maintenance of proper heating, ventilation and adequate drying out of the work is the responsibility of the contractor and any work damaged by dampness, insufficient or abnormal

heating, shall be replaced to the satisfaction of the Architect by and at the sole expense of the contractor.

E. Before and during the placing of gypsum and the application of other interior finishes, taping, varnishing, painting, etc. and until final acceptance by the Owner of all work covered by the Contract, the contractor shall, unless otherwise specified in the contract documents, maintain a temperature of 60 degrees F. Coordinate with Division 9 of the Technical Specifications.

F. Use of the permanent system, if approved by engineer and owner permission granted, shall not shorten, or negate any equipment, or system guarantees required under this contract. (the warranty period starts upon the date of Substantial Completion). Two additional filter changes are to be provided by Mechanical Contractor. A program of use, maintenance and restoration will be submitted with request for use of systems for temporary services.

3.06 TEMPORARY WATER

A. The Plumbing Contractor shall:
   1. Provide and maintain a temporary water system of size and capacity as required below to supply the needs of all Contractors for the work.
   2. Provide no less than two 3/4 inch hose bibs conveniently located at each building wing.
   3. Provide and pay for all connections and permits.
   4. Install such temporary water system so that service shall be available at the commencement of the work. The permanent water risers and lines may be used for temporary water supply. The permanent services shall be turned over to the Owner in perfect condition. Any repairs required due to temporary use shall be made at the sole expense of the plumbing contractor.
   5. Protect temporary and permanent lines against any damage.
   6. Remove all temporary lines when directed by the Owner's Construction Representative when such lines are no longer required.
   7. Water source is only available from building. If contractor decides distance is too far he should use water storage tanks or struck at no additional charge to the owner.

B. Each Contractor shall:
   1. Provide all hose and other extensions from connections installed by the Plumbing Contractor and all labor, materials and supplies required to supply water to the work.
   2. Prevent water damage to the work.

3.07 STORAGE FACILITIES

A. Each Contractor shall provide temporary storage shanties, tool houses and other facilities as required for their own use. Temporary structures shall be located at the staging area and shall be removed upon completion of the work or when directed.

B. Materials delivered to the site shall be safely stored and adequately protected against loss or damage. Particular care shall be taken to protect and cover materials that are liable to be damaged by the elements.

C. Due to limited on site storage space, each Contractor shall coordinate delivery of his materials with the Owner's Construction Representative who will determine when large deliveries shall be

made and shall be designate storage locations on site for delivered materials. All stored materials must be stored in locked, watertight trailers, paid for by applicable contractor.

3.08 SCAFFOLDING AND STAGING

A. All scaffold, staging and appurtenances thereto shall comply in total to the requirements of Safety and Health Regulations for Construction Chapter XVII of OSHA, Part 1926 and all related amendments.

3.09 RUBBISH CONTAINER

A. Each Contractor shall provide suitable rubbish container device(s) for his own use (both demolition and construction debris), properly maintained and serviced, replaced as required and protected from access by the public fencing as may be specified herein or approved by the Architect and Owner's Construction Representative.

B. Contractor and Subcontractor shall sweep up and gather together daily all his own rubbish and removed materials and place same in containers.

3.10 CONSTRUCTION FENCING

A. Construction fencing and barriers shall be provided by the General Construction Contractor, enclosing all work and storage areas as outlined in staging, plan and specified within. Temporary construction fencing shall be of good quality and neat in appearance.

B. Site access gates shall be provided as required, complete with all operating hardware and security devices.

C. Should fencing be required to be relocated or modified during the course of the project due to additional access needed by the contractor, same shall be done at the total expense of the contractor.

D. The construction fence shall be maintained in good order by all contractors throughout the life of the project.

E. Note: Should any contractor damage or cause the need for repair to the construction fence, all costs involved with said repair will be back-charged to the contractor creating the need for repair.

F. General Construction Contractor shall provide a 60’ x 150' fenced staging area at the location designated on the drawing for use by all trades. All fenced areas to be 6' high galvanized chain link fencing, 9 ga fabric on 10’ long framed sections on stanchions. Gate locations as directed by Owner's Construction Representative. If additional storage is necessary, the contractors may use the remote staging area where Owner's Construction Representative's trailer is located.

3.11 JANITORIAL SERVICE/DAILY CLEANUP

A. Each Contractor shall furnish daily janitorial services for the project and perform any required maintenance of facilities as deemed necessary by the Architect and Owner's Construction Representative during the entire life of the contract. If any contractor fails to keep the site safe

and broom clean within 4 hours of being notified by Architect or Owner's Construction Representative, either verbally or in writing, the Owner's Construction Representative will have the cleanup work performed by others and the contractors will be back charged accordingly.

1. The Contractor shall provide daily trash collection and cleanup of the project area and shall dispose of all discarded debris, and the like in a manner approved by the Owner's Construction Representative.

3.12 BURNING

A. Burning will not be permitted.

3.13 MAINTENANCE OF PERMANENT ROADWAYS

A. The General Construction Contractor shall immediately remove dirt and debris which may collect on permanent roadways created by their work, deliveries, manpower, equipment, etc.

B. Temporary roads / entrance mats will be maintained by General Construction Contractor to insure that no mud, dust, dirt goes onto asphalt areas.

3.14 FIRE PREVENTION CONTROL

A. Each Contractor shall comply with the safety provisions of the National Fire Protection Association’s “National Fire Codes” pertaining to the work and, particularly, in connection with any cutting or welding performed as part of the work.

3.15 TEMPORARY FIRE PROTECTION

A. Each Contractor shall take all possible precautions for the prevention of fires.

1. Where flame cutting torches, blow torches, or welding tools are required to be used, their use shall be as approved by the Owner's Construction Representative at the site.
2. When welding tools or torches of any type are in use, have available in the immediate vicinity of the work a fire extinguisher of the dry chemical 20 lbs. Type. The fire extinguisher(s) shall be provided and maintained by the Contractor doing such work.

B. Fuel for cutting and heating torches shall be gas only and shall be contained in Underwriters laboratory approved containers.

C. Storage of gas shall be in locations as approved by the Owner and subject to Fire Department regulations and requirements.

D. No volatile liquids shall be used for cleaning agents or as fuels for motorized equipment or tools within a building except with the express approval of the Owner and/or Architect and in accordance with local codes. On-site bulk storage of volatile liquids shall be outside the buildings at locations directed by the Owner, who shall determine the extent of volatile liquid allowed within the building at any given time.

E. Each Contractor shall comply with the following requirements relating to compressed gas:

1. Where compressed gas of any type is used for any purpose at the site, it shall be contained in cylinders complying with ICC regulations. Gases of different types shall not be stored together except when in use and when such proximity is required.

2. All gas cylinders shall be stored in sheds constructed of noncombustible materials. Sheds shall be well ventilated and without electric lights or fixtures and shall be located as far from other buildings as is practicable. All gas cylinders not in actual use, or in proposed immediate use, shall be removed from the building under construction or reconstruction. Empty gas cylinders shall be removed prior to bringing in a replacement cylinder. Cylinders shall at all times be supported and braced in an upright position. When not in use, the protective cap shall be screwed over the valve.
3. All persons required to handle gas cylinders or to act as temporary firemen (Fire Watchers) shall be able to read, write and understand the English language; they shall also be required by the Contractor to read Part 3 of Pamphlet P-1 “Safe Handling of Compressed Gases” published by the Compressed Gas Association, 500 Fifth Avenue, New York, NY 10036.
4. Where local ordinances are in effect regarding gas cylinders, (their use, appurtenances and handling), such ordinances shall supplement the requirements of this paragraph. All personnel engaged in fire watch shall be certified by the Local Fire Department having jurisdiction.
5. Any cylinder not having the proper ICC markings or re-inspection marking, or any cylinder with a leak shall be isolated immediately away from any building and the supplier shall be immediately notified; such other precautions as may be required to prevent damage or injury shall also be taken by the Contractor.

F. Each Contractor shall comply with the following requirements relating to welding and cutting:

1. All cutting and/or welding (electric or gas) must be done only by skilled, certified and licensed personnel.
2. During welding or cutting operations, a contractors man shall act as a fire watcher. The fire watcher shall have proper eye protection and suitable fire fighting equipment including fire extinguisher (bearing current inspection Certificate), protective gloves and any other equipment deemed necessary.
3. Welding or cutting shall not be done near flammable liquid, vapors or tanks containing such material.
4. Where cutting or welding is done above or adjacent to (within two feet) combustible material or persons, a shield of incombustible material shall be installed to protect against fire or injury to sparks or hot metal.
5. Tanks supplying gases for welding or cutting are to be placed in an upright position securely fastened, and close as practical to the operation. Tanks, actives or spares, shall be protected from excess heat and shall not be placed in stairways, hallways or exits. When not in use, protective valve cap shall be screwed on the cylinder.
6. Adequate fire extinguishing equipment shall be maintained at all welding or cutting operations.
7. The Contractor shall secure all required inspections.
8. All equipment, hoses, gauges, pressure reducing valves, torches, etc., shall be maintained in good working order and all defective equipment shall immediately be removed from the job.
9. No person shall be permitted to do any welding or cutting until his name, address and current license number have been submitted in writing to the Owner.

G. Contractors for work outside the building shall commence operations promptly on award of Contract, and shall be responsible for same being kept clear of materials and debris in connection with their own work and that of other Contractors. If a Contractor for outside work allows other

contractors to deposit material and debris over its lines, the Contractor shall be responsible for all delay and extra cost occasioned thereby.

3.16 DISCONTINUE, CHANGES AND REMOVAL

A. All Contractors shall:

1. Discontinue all temporary services required by the Contract when so directed by the Construction Manager or Architect.
2. The discontinuance of any such temporary service prior to the completion of the work shall not render the Owner liable for any additional cost entailed thereby and each Contractor shall thereafter furnish, at no additional cost to the Owner, any and all temporary service required by such Contractors work.
3. Remove and relocate such temporary facilities as directed by the Construction Manager or the Architect without additional cost to the Owner, and shall restore the site and the work to a condition satisfactory to the Owner.

3.17 VENTILATION AND HUMIDITY CONTROL FOR CONSTRUCTION:

A. General Construction Contractor will provide temporary ventilation as required for protecting the building from any adverse effects of high humidity during abatement and construction activities. Select dehumidification and ventilating equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements and have sufficient quantity of units to produce necessary ambient conditions.

1. Each Contractor shall be responsible for his own temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity.
2. Ventilate enclosed area to dissipate humidity, and to prevent accumulation of dust, fumes, vapors or gases.
3. Provide equipment as necessary for air and fresh exchange for the work area per OSHA standards.
4. Remove temporary ventilation equipment prior to the completion of construction.
5. If Contractor fails to adequately ventilate the building during the construction, abatement / roofing process, thereby causing humidity and possible mold issues, the owner will hire others to properly address and deduct costs from the Contractor accordingly.
6. General Construction Contractor will provide negative air machines of sufficient size/qty to fully ventilate the square footage of work areas and exhaust any dust/fumes through flexible duct hose to exterior top eliminate any orders / smoke.
7. Any contractor that allows water infiltration into any building shall be held responsible for the cleanup and provision of commercial dehumidifiers of sufficient size and quantity to prevent the generation of mold spore growth. Failure on the contractors part to address this issue within 4 hours of notice, will result in the Owner hiring outside parties to accomplish the required work in order to insure a safe environment. Owner will subsequently backcharge the contractor responsible for the water infiltration for all associated costs of hiring this outside contractor to carry out the work required.

3.18 TEMPORARY ROADS AND PERMANENT PAVED AREAS:

A. General Construction Contractor shall construct and maintain temporary road areas adequate to support loads and to withstand exposure to traffic during construction period. See staging plan for construction requirements, materials, thicknesses, locations, etc.

1. Includes access for delivery through staging area to building work areas, and to equipment and storage areas and sheds.
2. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.
3. Temporary areas are installed and/or maintained for access to all required areas of the sites.
4. Contractors will be permitted to utilize existing campus roads, as designated (as segregated by the Owner - if required).
5. Road Cleaning: Maintain roads and walkways in an acceptably clean condition. This includes the removal of debris daily, if required, and/or a minimum of once a week due to all project traffic. Road cleaning equipment to be wet/vacuum type. The General Construction Contractor will clean roads for debris from building-related activities.
6. General Construction Contractor shall provide snow plowing of temporary road, parking area, access route, and a 5’ walkway to office trailer. Provide snow removal and walking of walkways to Owner's Construction Representative office trailer. The school district will provide snow plowing of established routes.
7. Staging Areas:
    a. Temporary parking by construction personnel shall be allowed only in areas so designated and confirmed with the District.
    b. Traffic Regulations:
        1) Access through Owner’s entrances shall be limited. Confirm access locations and time frames with the District or Owner's Construction Representative when required.
        2) Utilize only entrances/temporary roads as designated.
        3) Maintain all District traffic regulations and site access.
        4) Construction parking will not be allowed adjacent to District buildings, additions or monuments. Construction parking will be located in areas designated by the District or Owner's Construction Representative.
        5) Construction employee parking to be located as directed by the Owner's Construction Representative.

3.19 TRAFFIC CONTROLS:

A. General Construction Construction Contractor shall provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads, barricades, flagmen, etc. Comply with requirements of authorities having jurisdiction.

3.20 DEWATERING FACILITIES AND DRAINS

A. Each Prime Contractor is directly responsible for dewatering of their excavations. The responsibility of dewatering of the site as to facilitate the work will be the responsibility of the General Construction Contractor, coordinate with the Owner's Construction Representative

B. Comply with requirements in applicable Division 31 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in

individual Sections. Where feasible, common use of dewatering and drainage facilities is recommended. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties, nor endanger permanent drainage systems. Provide temporary drainage where roofing or similar waterproof deck construction has been completed.

C. Remove snow and ice, on a daily basis, to minimize accumulations.

3.21 ROOF PROTECTIONS

A. The General Construction Contractor shall provide temporary protection on the roof surface when it is necessary for work to take place on completed roof areas. Other Primes shall be held responsible to notify the General Construction Contractor of their work and required roof protection areas.

B. When requested by other trades as noted above, the General Construction Contractor shall provide a minimum of 2 inch thick Polyisocyanurate or Extruded Polystyrene (40 psi) rigid insulation with a 5/8” plywood overlay to protect existing roofing system from damage. Provide removable weighting systems to protect against wind uplift / blow-offs of these protective materials.

C. Based upon the requirements noted above, the General Construction Contractor shall assume responsibility for any damage(s) to the roofing system caused by the work of other trades, except that financial responsibility for any damage(s) to the roofing system shall be that of the Contractor responsible for the damage(s) as determined by the Owner's Construction Representative.

3.22 SIGNAGE

A. The General Construction Contractor shall provide signs as required below. Install signs where required or indicated to inform public and persons seeking entrance to project site. All signage and posts provided shall become the property of the District at the conclusion of the project.

B. Prepare temporary signs to provide directional information to construction personnel and visitors.

C. Construct signs in accordance with section 619 of the NYS DOT standard specifications (MUTCD overall sign size, letter size, metal signage). Support on breakaway metal posts or attach to fencing using zip ties to prevent unauthorized removal; do not attach signs to buildings or permanent construction.

D. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer. Engage an experienced sign painter or fabricator to apply graphics. Signs shall have an orange background with black letters/graphics unless directed otherwise.

E. Include relocating temporary site safety and directional signs as many times as required or directed by the Owner's Construction Representative.

F. The General Construction Contractor shall furnish, install and relocate all construction signage as required at each project site.

G. Project Sign Requirements:

1. Ten (10) signs shall be provided and located (and relocated) as designated by the District or Owner's Construction Representative for construction traffic control/flow at entrances/exits.
2. Four (4) signs for "Construction Parking".
3. Four (4) signs to direct deliveries
4. Ten (10) signs for "Emergency egress only - Construction Area" per OSHA standards.
5. Ten (10) signs for “No Smoking” safe work site at multiple locations as directed by Owner's Construction Representative.
6. Fifteen (15) signs for "Construction Area - Do Not Enter" mount on fence as directed by the Owner's Construction Representative.
7. Ten (10) signs for "No Trespassing" mounted on construction fence as directed by the Owner's Construction Representative.

H. A pre-mobilization meeting to establish location and quantities of all signage will be held with contractor, Construction Manager, and the Owner. Prior to the start of any actual work the signage must be reviewed / approved by the Owner's Construction Representative.

3.23 ENVIRONMENTAL PROTECTION:

A. The General Construction Contractor shall provide protection, operate temporary facilities, and conduct construction with means and methods that comply with local and state environmental regulations and that minimize possible air, waterway, and subsoil contamination, pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict the use of noise-producing tools and equipment to hours that will minimize complaints from persons, residential occupants, or firms near Project site.

3.24 STORMWATER CONTROL

A. The General Construction Contractor shall provide earthen embankments, silt fencing, haybales, and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater.

3.25 SECURITY ENCLOSURE AND LOCKUP:

A. Each Contractor shall provide protection and security for partially completed areas of construction. Provide barricades to prevent unauthorized access, vandalism, theft, and similar violations of security.

3.26 BARRICADES, WARNING SIGNS AND LIGHTS:

A. Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard.

1. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch thick exterior grade APA BC plywood with structurally adequate supports and/or scaffolding as approved by the Owner's Construction Representative.

3.27 TEMPORARY ENCLOSURES

A. The General Construction Contractor shall provide temporary enclosures for protection of construction from exposure to inclement weather and for safety of any roof related openings. Close openings in roof deck with load bearing wood frame construction members (sized for design roof loads), 5/8" exterior grade, structural 1, APA BC plywood and watertight EPDM adhered membrane.

B. The General Construction Contractor shall fully enclose all windows / door openings. Maintain access and egress for workers via secured temporary doors / gates. During periods of temporary heat provisions, provide 5/8 inch, exterior grade, APA BC plywood with 2 inch rigid polyisocyanurate and 6 mil polyethylene sheeting for a weather-tight, secure and insulated enclosure. Temporary doors shall each have an exit device and door closer.

C. Any other temporary enclosures for specific openings for any contractor to perform their work shall be the responsibility of the contractor requiring / creating the opening. These openings shall be installed to protect the building from exterior elements, security issues, odors and noise resulting from construction operations.

3.28 TEMPORARY PARTITIONS

A. The General Construction Contractor shall erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate work areas.

1. Construct dustproof, floor to ceiling partitions of not less than 3-5/8” - 20 ga. studs; 2 layers of 6 mil fire-retardant polyethylene sheets inside / outside; 5/8 inch thick exterior grade plywood sheathing; 5/8 inch thick interior, Type X gypsum board, taped spackled (1 coat) and painted.
2. Cover floor with 2 layer fire retardant polyethylene and extend 18 inches vertically at each side. Overlap and tape all joints.
3. Sound insulate partitions to provide noise protection to occupied areas
4. Caulk joints and perimeter to prevent dust migration. Equip partitions with dustproof doors and security locks.
5. In addition to any temporary partition locations shown on drawings, the General Construction Contractor shall include in its base bid a minimum of six (6), 9 foot by 12 foot temporary partitions meeting criteria listed above for use and located where directed by the Owner's Construction Representative. Each location shall be equipped with a 3 foot wide by 7 foot high hollow metal door/frame with hinges, closer and exit device hardware.

3.29 AREA OF SPECIAL PROTECTION

A. In the event of an emergency (designated by the sounding of the fire alarm system) all construction activities must immediately cease. Contractor’s work force will evacuate themselves from work areas and remain outside of work areas until the “all clear" is given. No work operations will be tolerated during the evacuation of the building or during an emergency.

B. Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and

subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.30 OPERATION, TERMINATION AND REMOVAL:

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage.
   1. Maintain operation of temporary enclosures on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
   2. Protection: Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended and no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been affected because of interference with the temporary construction / facilities. Repair damaged work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are the property and responsibility of the General Construction Contractor.
   2. At Substantial Completion, clean, repair and renovate permanent facilities used during the construction period.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Work of this Section includes the furnishing of the Owner's Construction Representative's Field Office (Trailer).
   1. The Owner's Construction Representative's Field Office shall be furnished by the General Construction Contractor.
   2. It shall be provided within the time period specified hereinafter.

B. The General Construction Contractor shall also furnish the following to the Owner/ Owner's Construction Representative's all in accordance with the specifications contained herein as follows:
   1. Miscellaneous equipment and supplies
   2. Materials
   3. Computer system with associated peripheral computer related equipment
   4. Services as may be specified herein.

C. The Electrical Contractor shall install two (2) new telephone services (telephone and fax/modem) for the exclusive use of the Owner's Construction Representative's. The telephone services shall be provided to the Construction Manager's construction trailer located on the site as selected by the Owner's Construction Representative's. The costs associated with providing the Owner's Construction Representative's's telephone services shall be included in the price as-bid and is not eligible for payment out of any cash allowance.

D. This Section also specifies the requirements for Field Offices to be established by all Prime Contractors for the exclusive use of the respective Prime Contractor.

1.02 CARE AND PLACEMENT

A. Field offices shall be placed where directed by the Owner's Construction Representatives's in accordance with site utilization requirements.

B. All field offices shall be installed to meet all standards of the Occupational Safety and Health Act of 1970 and subsequent revisions.

C. In the event of damage to existing facilities, including but not limited to: tanks, driveways, walks, pavement, buildings, pipes, conduits, valves, and electrical facilities then immediately make all repairs and replacements to an equal condition prior to the event.

1.03 QUALITY PERFORMANCE

A. Comply with and perform all work in accordance with the requirements of local authorities and utility companies having jurisdiction.

1.04 SUBMITTALS

A. The General Construction Contractor shall submit the following:
   1. Floor plan of the proposed Field Office of the Owner's Construction Representative's.
   2. Catalog cuts of miscellaneous equipment and supplies if they are different from that specified.

B. The Contractor shall also provide a listing of the companies providing specified services with telephone number and contact name. Provide references for each company when requested.

PART 2 - PRODUCTS

2.01 OFFICE OF PRIME CONTRACTORS

A. The General Construction and the other Prime Contractors shall provide and maintain during the life of this contract separate and suitable offices at the site that shall be used as the Contractor's superintendent office.

B. Provide adequate facilities for maintaining record documents, for holding small meetings and a telephone upon which calls may be received from Owner, Architect/Engineer and others. The telephone shall be equipped with a fax machine and an answering machine.

C. Each Contractor shall install, maintain, and repair if necessary, temporary electric and telephone to their own field office.

2.02 **MATERIALS, EQUIPMENT AND SERVICES FURNISHED TO THE OWNER BY THE GENERAL CONSTRUCTION CONTRACTOR**

A. The General Construction Contractor shall also furnish the following equipment and services that shall not be eligible under any cash allowance. All items specified herein shall be new and remain the property of the Owner unless otherwise stated. The following shall be furnished:

1. Two (2) 23-gallon plastic wastepaper basket.
2. New 50-person industrial first aid station, OSHA approved, by Acme United or equal, order no. ACM-1403 (Huntington Business Products) or equal.
3. Thermometer, with indoor and outdoor sensing bulbs, and high, low instantaneous reading, with magnetic reset function by Radio Shack or equal.
4. Two U.L. and F.M. approved fire extinguishers with a minimum rating of 4A-60B:C.
5. Standard manufacturer operating manuals for all equipment supplied.
6. One (1) 30" x 60" desk with 4 side drawers and a locking center drawer.
7. One (1) new swivel task chair for use with desk equal to order no. SUP-12223643 by Superior Chair (Huntington Business Products).
8. One (1) new rolling stand with top, Model No. 76MR/76TP from Plan Hold, catalog #27, or equal.
9. Two (2) 48" x 60" reference tables.
10. Six (6) folding chairs.

B. Janitorial Services - Provide janitorial services two (2) times each week. Thoroughly clean and dust entire office and leave in a condition satisfactory to Architect/Engineer. Provide this service through final completion.

C. Ownership of Furnishings - All items to be provided by Contractor under this paragraph shall remain the property of the Owner unless otherwise stated.

D. Internet Access Service - The Contractor shall also pay for monthly Internet access fees at a cost not to exceed $45.00 per month for the length of the contract up to the date of final completion.

1. This cost shall be included in the price as bid and shall be billed directly to the General Construction Contractor.
2. The service provider shall be selected by the Architect/Engineer. The General Construction Contractor shall arrange for the service.
3. Internet access will be used by the Architect/Engineer and the Owner to send email to manufacturers, vendors, Architect/Engineer's home office, the Contractor's home office, other prime Contractors, regulatory agencies and the like.
4. The Contractor may use this service at the discretion of the Architect/Engineer. Only project related transmissions will be allowed.
5. If high speed DSL or cable service is available, then the Contractor shall arrange for this service in lieu of a dial up service.

E. All items specified herein are subject to the approval of the Architect/Engineer or the Owner's Construction Representative's.

F. Equipment shall be delivered to the site and turned over to the Architect/Engineer via a type written transmittal form.

G. All equipment that is to remain the property of the Contractor shall be new.
1. Equipment that is to remain the property of the Owner shall also be new and be provided in it's factory packaging, unopened until delivered to the Owner/Architect/Engineer.
2. Maintenance of all supplied equipment shall be the Contractor's responsibility up to substantial completion.

H. All items shall be delivered prior to the first application for payment, but no later than the day the Owner's Construction Representative's's Trailer is delivered.

I. Construction Manager's Field Trailer:
1. Office - The General Construction Contractor shall furnish, equip, and maintain a field office at the site for the exclusive use of Owner/Architect/Engineer.
   a. The field office shall be of substantial weatherproof construction, with a usable floor space of not less than 10' x 40' overall.
   b. Office may be in an approved, near new condition, independent trailer, completely skirted with insulation and with sufficient landings and stairs at each door.
   c. Submit a scaled floor plan of the trailer.
2. Duration - Provide office by no later than 30 calendar days from the date of the Notice To Proceed and maintained during the life of the Contract, up to the date of the Final Certificate.
3. Location - As directed by Owner/Architect/Engineer or Owner's Construction Representative's. Relocate during the progress of the work, without additional cost to Owner, as may be required by the Owner/Architect/Engineer or Owner's Construction Representative's.
4. Utilities - Provide the following in sufficient size, quantity, and capacity, as approved by the Owner/Architect/Engineer.
   a. Windows for natural light and ventilation, with locks, screens, and shades or curtains.
   b. Lighting acceptable to the Owner/Architect/Engineer/Owner's Construction Representative's.
   c. Door with screen, with hasp and padlock and five keys for Owner/Architect/Engineer's use. Two (2) doors minimum. Provide two (2) commercial grade foot mats at each door.
   d. Air conditioning unit and heater in each room, sized to maintain an indoor temperature of 60 deg. F with an outdoor temperature range of 10 deg. F to 90 deg. F.

e. 110 volts, 100-amp electric service with sufficient receptacles spaced around the room.

2.03 REMOVALS

A. Remove all items provided under this Section except as otherwise specified.

PART 3 - EXECUTION

3.01 REMOVAL OF UTILITIES, FACILITIES AND CONTROLS

A. Remove temporary above grade or buried utilities, equipment, facilities and materials.

B. Remove underground installations to a minimum depth of 2 feet or as specified elsewhere.

C. Regrade area to existing slope and elevation and restore the surface to its existing condition or to the condition shown on the Contract Drawings.

D. The General Construction Contractor shall inventory all equipment that has been turned back to the Contractor prior to agreeing to final payment.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes the general requirements for products that are to be furnished, installed, or otherwise incorporated into the project.

1.02 QUALITY ASSURANCE APPLIES TO ALL PRODUCTS

A. In addition to the Contractor's warranties and guarantees on materials and equipment required under the General Conditions of the Contract and the Technical Specifications contained hereinafter, the Contractor shall also be responsible for all materials, equipment, and products that have or is planned to be incorporated into the work.
   1. The Contractor shall be responsible for the finished work and that it accurately and completely complies with these Contract Documents.
   2. The Contractor shall be responsible for work performed by subcontractors, equipment suppliers, and material vendors.
   3. The Contractor shall be satisfied as to the product's performance before it is ordered for installation. At the Contractor's option, he/she shall have tested each product to determine compliance with these specifications.

B. The Architect/Engineer may check all or any portion of the work and the Contractor shall afford all necessary assistance to the Architect/Engineer in carrying out such checks.
   1. Such checking by the Architect/Engineer shall not relieve the Contractor of any responsibilities for the accuracy or completeness of the work.
   2. Such checking is a courtesy service being provided by the Owner and does not relieve the Contractor of his/her responsibilities under this Construction Contract.

C. If witnessed shop tests or inspections are required at the point of manufacture, the Contractor shall keep the Architect/Engineer advised as to the progress of the work to allow inspection at the proper time and place. Provide at least two (2) weeks advance notice before scheduled shop tests.

D. Should a dispute arise as to the quality of workmanship, equipment or material performance, then the final decision regarding acceptability with these Contract Documents shall be that of the Owner.

E. At the request of the Architect/Engineer, the Contractor shall promptly provide the services of a competent representative of the manufacturer at the project site, fully equipped and prepared to answer questions, perform tests, make adjustments and to prove compliance with the Contract Documents free of all additional charges. Proof of compliance shall be the responsibility of the Contractor, and such special visits to the project site by the manufacturer shall not be eligible under any cash allowances or stipulated man-hours necessary to startup the system and/or train the Owner as may be specified in the Technical Specifications.

1.03 QUALITY ASSURANCE - EQUIPMENT

A. Erect and install products under the supervision of a competent and experienced superintendent. The method of installation, including anchorage, clearances, and tolerances for rotating assemblies, methods of support for equipment and adjacent piping, shall be as recommended by the equipment manufacturer unless detailed on the Drawings or specified.

B. All material furnished shall be new, and guaranteed free from defects in workmanship, installation, and design.

C. Design and fabricate equipment in conformance with ANSI, ASTM, ASME, ASHRAE, IEEE, NEC and NEMA Standards.

1. Equipment shall withstand the stresses that may occur during fabrication, testing, transportation, installation and conditions of operation.
2. Pumps shall conform to the requirements of the Hydraulic Institute.
3. Equipment shall comply with the latest OSHA regulations and the ANSI Safety Standards.

D. Equipment shall be products of manufacturers who produce evidence of their ability to promptly furnish any and all interchangeable replacement parts as may be needed at any time within the expected life of the equipment.

E. Manufacturers shall also have readily available access to suitable and accurate testing facilities for performing the required shop tests.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Equipment shall have been in successful regular operation under comparable conditions for a period of at least five (5) years.

1. This time requirement does not apply when the manufacturer posts an Owner/Architect/Engineer acceptable Performance Bond or Letter of Credit for the duration of the time period that will guarantee replacement of the equipment in the event of failure.
2. The bond shall be in a form that is acceptable to the Owner’s legal council.

B. The Owner reserves the right to reject any material or equipment manufacturer who, although he appears to be qualified and meets the technical requirements, does not provide satisfactory evidence indicating adequate and prompt post-installation repair and maintenance service, as required to suit the operational requirements of the Owner.

C. Whenever it is required that the Contractor furnish materials or manufactured articles or shall do work for which no detailed specifications are set forth, the materials or manufactured articles shall be of the best grade in quality and workmanship obtainable on the market from firms of established good reputation, or, if not ordinarily carried in stock, shall conform to the usual standards for first-class materials or articles of the kind required.

D. Perform work in full conformity and harmony with the intent to secure the best standard of construction and equipment of the work as a whole or in part.

E. Items of any one type of material or equipment shall be the product of a single manufacturer.
   1. For ease of the Owner in maintaining and obtaining service for equipment and for obtaining spare parts from as few places as possible, to the maximum extent possible, use equipment of a single manufacturer.
   2. The Architect/Engineer reserves the right to reject any equipment from various manufacturers if suitable equipment can be secured from fewer manufacturers and to require that source of materials be unified to the maximum extent possible.

F. Substitute equipment shall not be fabricated nor installed until after written decision to accept request is received from the Architect/Engineer.

2.02 NAMEPLATES

A. Each unit of equipment shall have the manufacturer's name or trademark on a stainless steel nameplate securely affixed in a conspicuous place.

B. The manufacturer's name or trademark may be cast integrally with stamp, or otherwise permanently marked upon the item of equipment.

C. Such other information as the manufacturer may consider necessary for complete identification shall be shown on the nameplate.

2.03 FABRICATIONS

A. Insofar as possible, shop prefabricate all items complete and ready for installation.

B. Accurately fabricate all items to the details shown on the Drawings and on the shop drawings found in compliance with the Contract Documents.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to work under any Section, carefully inspect the existing work and verify that it is complete to the point where the work under that Section may properly commence.

B. Avoid the need to remove and replace work and to avoid unnecessary cutting and patching.

C. Inspect all surfaces to be sure that they have been properly prepared before applying new work to such surfaces.

D. Verify that all work can be installed in strict accordance with the drawings and the approved shop drawings. Immediately report discrepancies to Architect/Engineer.

E. Do not proceed with the work under any Section until these conditions are obtained.

3.02 INSTALLATION

A. Furnish and install materials and equipment in accordance with the instructions of the applicable manufacturer, fabricator or processors, except as otherwise provided in the Contract Documents.

B. All work shall be done in a workmanlike manner and set to proper lines and grades. The work shall be square, plumb and/or level as the case may be.

C. Where performance criteria are specified, do all work necessary to attain the required end results.

3.03 FIELD QUALITY CONTROL

A. Neither observations by Architect/Engineer nor inspections, tests or approvals by other persons shall relieve the Contractor from his obligations to perform the work in accordance with the requirements of the Contract Documents.

B. If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any work to specifically be inspected, tested or approved by some public body, the Contractor shall assume full responsibility therefore, pay all costs in connection therewith, and furnish the Architect/Engineer with the required certificates of inspection, testing or approval.

C. The Owner reserves the right to independently perform laboratory tests on random samples of material or performance tests on equipment delivered to the site.

1. These tests, if made, will be conducted in accordance with the appropriate referenced standards or specification requirements.
2. The entire shipment represented by a given sample, samples or piece of equipment may be rejected on the basis of the failure of samples or pieces of equipment to meet specified test requirements.
3. All rejected materials or equipment shall be removed from the site, whether stored or installed in the work, and the required replacements shall be made, all at no additional cost to Owner.

3.04 ADJUST AND CLEAN

A. Upon the completion of installations, and as a condition of its acceptance, visually inspect all work, adjust all components for proper alignment and touch-up abrasions and scratches to make them completely invisible.

B. Thoroughly examine all materials and equipment with protective or decorative finishes for defects and damage prior to being covered.

1. In the case of buried items of work, restore protective surface covers so as to conform to the Contract Documents prior to being backfilled, buried or embedded, as the case may be.
2. In the case of exposed items of work, for which a decorative finish is required, all scratches, discoloration’s, unmatched colors, disfigurations and damages shall be repaired and touched-up so as to provide a neat, clean finish, and be uniform in color.

3.05 UNCOVERING WORK

A. Unless otherwise specified or directed by Architect/Engineer, no work shall be covered until it has been observed, tested, photographed, measured, and authorized to be covered by Architect/Engineer.

B. Tie distances to above ground physical structures as reference points to all underground utilities, conduits, pits, manholes, valves, and pipelines shall be obtained by the Contractor prior to covering the work. Immediately comply with the Architect/Engineer’s direction to uncover the work if tie distances were not obtained.

C. If any work has been covered with Architect/Engineer's consent and Architect/Engineer considers it necessary or advisable that covered work be observed or tested, the Contractor, at Architect/Engineer's request, shall uncover, expose or otherwise make available for observation, or testing as Architect/Engineer may require, that portion of the work in question, furnishing all necessary labor, material and equipment.

1. If it is found that such work is defective, the Contractor shall bear all the expenses of such uncovering, exposure, observation, and testing of satisfactory reconstruction, including compensation for additional engineering services and an appropriate deductive change order shall be issued.
2. If, however, such work is not found to be defective, the Contractor shall be allowed an increase in the contract price or an extension of the contract time, or both, directly attributable to such uncovering, exposure, observation, testing and reconstruction if he makes a claim therefore as provided in the General Conditions.

3.06 DEFECTIVE WORK

A. The repair, removal, replacement and correction of defective work is a part of this Contract and shall be promptly performed in accordance with the requirements set forth in the General Conditions or other portions of the Contract Documents. All costs in connection with the correction of defective work shall be borne by the Contractor.

B. Products that fail to maintain the performance or other salient requirements of the Contract Documents, shows undue wear, or other deleterious effects during the maintenance period, shall be considered defective.

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Section includes the transportation, handling, storage and protection of products that are to be incorporated into the work.

B. The procedures for turning equipment over to the Owner for installation by others is also included herein.

1.02 GENERAL

A. Items shall be delivered as complete assemblies direct from the manufacturer with all internal wiring, piping, valving, and control devices intact except where partial disassembly is required by transportation regulations, protection of components, or where physical constraints may exist or be created for the setting of the item.

B. Coordinate the disassembly and reassembly requirements with the manufacturer. Determine the need and extent of reassembly prior to bid.

1. All labor, material and equipment costs associated with the disassembly and reassembly of the product shall be included in the Contract Price.
2. Where reassembly of equipment is necessary, then the manufacturer shall provide reassembly instruction at the project site.
3. A technician shall be present during the entire reassembly procedure and the manufacturer shall certify, in writing, that the unit was reassembled properly in accordance with instructions provided by the manufacturer and that all as-specified warranties remain in effect.
4. The manufacturer's reassembly inspection time shall be in addition to the field service time specified and shall be included in the Contract Price. This time shall not be eligible for payment under any cash allowance item.

C. In the case where equipment is to be installed by others, then the supplying contractor shall be responsible for its reassembly. If reassembly is necessary and the unit(s) are to be set inside an enclosure or building, reassemble the equipment inside said enclosure. The equipment once reassembled shall be turned over to the installing contractor as specified below.

1.03 PACKING

A. Transport products in containers, crates, boxes or similar means such that the products are protected against damage that may occur during transportation.

B. All parts shall be packaged separately or in container where parts of similar systems are grouped.

C. Part numbers shall be indicated on the individual part. Use indelible ink to mark part numbers.

D. All equipment shipments shall be included with a parts list showing a description (name) of the part and the manufacturer's part number.

1. The parts list shall be shipped in a plastic zippered envelope with the words "Parts List" lettered on it in indelible ink.

2. The parts list shall be placed inside the shipping container so that it is on the top of the contents.

E. Equipment shall be shipped with storage, handling and installation instructions.

1. The Engineer reserves the right to withhold payment for equipment delivered to the site until such time as the storage, handling and installation instructions are supplied by the manufacturer.
2. In the case where operation and maintenance manuals have been provided by the manufacturer, which includes the installation instructions, then the installation instructions shall also be included with the equipment shipment.

F. Delicate instruments and devices, reagents, chemicals, and glassware shall be shipped in packaging normally provided by the manufacturer.

G. The Contractor shall require the manufacturer to be responsible for the proper packing of all products.

1.04 SHIPPING AND DELIVERY

A. Product deliveries shall be accompanied with a bill of lading indicating the place of origination and the Contractor's purchase order number.

B. Inspect shipments immediately upon delivery, to assure compliance with requirements of the Contract Documents and those products are undamaged.

C. Promptly remove damaged material and unsuitable items from the job site.

D. Provide equipment and personnel to handle products by methods to prevent soiling; disfigurement or damage.

1.05 STORAGE

A. Store sensitive products and all spare parts in weather tight, climate controlled enclosures in an environment favorable to product.

B. Store and protect products in accordance with the manufacturer's instructions.

C. All other products that are to be installed underground or products such as pipe, valves, and fittings shall be stored outdoors but shall be blocked off the ground and covered with impervious sheet coverings.

D. Store fabricated products above the ground on blocking or skids.

E. Store loose granular materials in well-drained areas on solid surfaces to prevent mixing with foreign matter.

F. Provide adequate ventilation to avoid condensation.

G. In accordance with manufacturer's instructions protect bearings, couplings, shafts, rotating components, and assemblies. Protection of said equipment shall be continuous until the time the equipment is placed into permanent service.

H. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.

I. Do not store volatile liquids in any building on site.

J. Storage of products shall be the responsibility of the supplying contractor. The installing contractor shall take all necessary precautions to protect the equipment being furnished by others.

K. Store with seals and labels intact and legible.

1.06 EQUIPMENT INSTALLED BY OTHERS

A. All products, except products noted on the Drawings or specified, shall be furnished and installed under this Contract.
   1. Only noted or specified products shall be furnished under this Contract for installation by others.
   2. If it is not noted on the Drawings or specified, then the product shall be furnished and installed under the Contract.

B. The Contractor shall furnish these products to the Owner. These products shall be stored as specified above.

C. The Owner will then advise the installing contractor that the product(s) are ready for installation.
   1. In the case where the product is stored in a proper enclosure, but not stored inside the building to be constructed under this project, then the installing contractor shall move the product into the building to a location adjacent to the final location shown on the Drawings.
   2. In all cases, the installing contractor shall be responsible for moving from storage, uncrating, anchoring, mounting and installing the product as required by the Contract Documents.

D. The Contractor and installing contractor(s) shall be present at the time the equipment is turned over to the Owner. Immediately thereafter, the Owner will turn the product over to the installing contractor for installation.

E. The Owner, Contractor, Architect/Engineer and the installing contractor shall inspect the condition of the product at this time.
   1. Any defects in the product will be noted and the Contractor will be advised to make all repairs immediately.
   2. The installing contractor shall still be required to install the product if the damage is deemed cosmetic by the Architect/Engineer.
   3. The manufacturer's installation instructions or wiring diagram shall be turned over to the installing contractor at this time by the Contractor.
   4. Any damage occurring to the product during moving, setting and mounting the unit(s) shall be the responsibility of the installing contractor.
   5. The Contractor is advised to take photographs to document the condition prior to it being turned over to the installing contractor.
   6. The installing contractor is advised to take photographs to document the condition prior to its acceptance.

F. The supplied unit(s) remain the property of the Contractor until final acceptance of the work.

G. Any damage caused to the unit(s) due to improper installation, workmanship, and non-compliance with the manufacturer's written installation instructions shall be the responsibility of the contractor who caused said damage. The burden of proof shall rest with the supplying Contractor.

H. In the event the Contractor discovers misuse, abuse or improper installation of the unit(s) by the installing contractor, then he shall immediately notify the Architect/Engineer in writing. The Architect/Engineer will investigate the accusations and make a determination. The Architect/Engineer's determination shall be binding and agreed to by both parties.

I. If the Architect/Engineer's determination substantiates the accusations of the Contractor, then the Contractor shall install the unit(s), the costs for which will be paid for as extra work. All costs associated with the extra work change order, including engineering and attorney fees of the Owner and Contractor will be deducted from money due the installing contractor.

1.07 PROTECTION OF WORK

A. The Contractor shall protect the installed work. All costs for protection shall be borne by the Contractor. Provide coverings as necessary to protect installed products from damage, from traffic and subsequent construction operations. Remove when no longer needed.

B. Cover and protect equipment from dust, moisture or physical damage. Protect finished floor surfaces prior to allowing equipment or materials to be moved over such surfaces. Maintain finished surfaces clean, unmarred and suitably protected until accepted by the Owner.

C. Additional time required to secure replacements and to make repairs will not be considered by the Architect/Engineer to justify any extension in the Contract Time of Completion. In the event of the damage, promptly make replacement and repairs to the approval of the Engineer at no additional costs.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section This Section includes administrative and procedural requirements for cutting and patching.

B. Definition: "Cutting and patching" includes cutting into existing construction to provide for the installation or performance of other work and subsequent fitting and patching required to restore surfaces to their original condition, and does not apply to new construction procedures, except when new construction is already completed and must be cut and patched due to incorrect sequencing of work and/or improper coordination.

C. Provisions of this Section apply to the construction activities of each prime Contractor. Contractors are reminded that they will need to hire tradesman skilled in the patching finishes that are impacted by their activities. (e.g. plumber will need to have a mason patch back existing walls opened for new roughing , Heating Contractor will hire carpenter for existing ceiling replacements after new air handler installed, etc)

D. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section 013100 - {\t\#1000055} for procedures for coordinating cutting and patching with other construction activities.
2. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
    a. Requirements of this Section apply to all trades. Refer to specification sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.02 RESPONSIBILITIES

A. General: Each Prime Contractor is responsible to perform cutting and patching for their portion of the Work. Patching work shall restore all surfaces to their original condition.

B. Cutting and patching of completed new construction required due to out of sequence construction and/or improper coordination is the responsibility of the prime Contractor responsible for the out of sequence construction or improper coordination. Cutting and patching of new construction for these purposes shall be accomplished by the General Construction Contractor and shall be paid for by the prime Contractor responsible. The Owner's Construction Representative shall be the sole judge of the responsibility for such cutting and patching, and shall prepare change orders to delete monies from the responsible prime Contract and credit those monies to the General Construction Contractor.

1. Each Contractor shall cooperate with the Owner's Construction Representative to accomplish cutting and patching with minimal disruption to the construction and at reasonable cost.

1.03 SUBMITTALS

A. Cutting and Patching Plan: If the Owner requires approval of cutting and patching procedures before proceeding, submit a plan describing cutting and patching procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the submittal:

1. Describe the extent of cutting and patching required. Show how it will be performed and indicate why it cannot be avoided.
2. Describe anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
3. List products to be used and firms or entities that will perform the work.
4. Indicate dates when cutting and patching will be performed.
5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated, including their new locations, and those that will be required to be placed temporarily out-of-service. Indicate how long service will be disrupted and when service will be restored..
6. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of additional reinforcement with the original structure.
    a. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of unsatisfactory work.
    b. Submit a detailed plan, including an area-specific drawing, indicating how dust mitigation and noise control will be handled to prevent disruption/dusting of adjacent areas. Identify routes of waste removal and dumpster locations, material handling from staging area, placement of protections, controls, etc.

1.04 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
    a. Bearing and retaining walls.
    b. Structural concrete.
    c. Structural steel.
    d. Lintels.
    e. Structural decking.
    f. Miscellaneous structural metals.
    g. Exterior curtain-wall construction.
    h. Equipment supports.
    i. Piping, ductwork, vessels, and equipment

B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
    a. Primary operational systems and equipment.
    b. Air or smoke barriers.
    c. Water, moisture, or vapor barriers.
    d. Membranes and flashings.
    e. Fire protection systems.
    f. Noise and vibration control elements and systems.
    g. Control systems.
    h. Communication systems.
    i. Conveying systems.
    j. Electrical wiring systems.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner.

1.05 WARRANTY

A. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner so as not to void any existing or required warranties.

B. Utilize manufacturer certified installers for work on any existing roof area, which are impacted, to ensure that the owners current warranty is maintained in full force.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible. If identical materials are not available or cannot be used, use materials whose installed performance will be equal to or surpass that of the existing materials.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.

1. Before proceeding, meet at the Project Site with parties involved in cutting and patching, including but not limited to; Owner's Construction Representative, mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.02 PREPARATION

A. Temporary Support: Provide temporary support of work to be cut, including shoring, lumber, plywood, etc.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

C. Avoid interference with the use of adjoining areas or interruption of free passage to adjoining areas.

D. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

3.03 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction. Where possible, review proposed procedures with the original Installer; comply with the original Installer's recommendations.

1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
3. Cut through concrete and masonry using a cutting machine, such as a Carborundum saw or a diamond-core drill.
4. Comply with requirements of applicable Division 2 Sections where cutting and patching requires excavating and backfilling.
5. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible or to match existing where exposed for aesthetic appearance. Comply with specified tolerances. Patching will be done utilizing tradesmen skilled for the surface to be patched. (e.g. mason for brickwork, ceramic tile installer for ceramic tile, etc)

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

If patched area does not match the adjacent surface, the contractor will refinish the entire wall to achieve a uniform surface.

3. Where removal of walls or partitions extends one finished area into another, patch and repair floor, ceiling and wall surfaces in the new space. Provide an aligned, flush surface of uniform color and appearance. Provide grinding, leveling and/or self-leveling of surfaces since adjacent room surfaces may vary in elevation. Remove existing floor and wall coverings and ceiling materials and replace with new materials, if necessary, to achieve uniform color and appearance.
    a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch after the area has received primer and second coat.
4. Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.04 CLEANING

A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying primer and paint or other finishing materials. Restore damaged pipe covering to its original condition

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cleaning during the progress of the work.

B. Maintain all premises and public properties/roadways free from accumulations of waste, debris, dirt, mud and rubbish caused by operations on a daily basis.

C. At completion of work, remove waste materials, rubbish tools, equipment, machinery and surplus materials, and clean all exposed surfaces; leave project clean, dust free and ready for occupancy,

D. Remove all overspray caused by construction operations from adjacent construction, surfaces and vehicles.

E. Cleaning prior to final payment

1.02 SCHEDULING

A. Sequence, schedule, and coordinate final cleaning work with the final cleaning work to be performed by other prime contractors.

1.03 SAFETY REQUIREMENTS

A. Standards: Maintain project in accord with OSHA and other applicable safety and insurance standards.

B. Hazard Control / Cleaning Products:

1. Store volatile organic containing / flammable waste in covered metal containers and remove from premises daily.
2. Provide adequate ventilation during use of VOC containing or noxious substances.

C. Conduct cleaning and disposal operations to comply with local ordinances, OTC regulations and local anti-pollution laws and ordinances.

D. Dispose of all waste legally, off-site.

E. Do not dispose of VOC / flammable waste such as mineral spirits, oil, or paint thinners into storm or sanitary drains.

F. Do not burn or bury rubbish and waste materials on project site.

G. Do not dispose of any waste into surface waters such as ponds, lakes, streams or waterways

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cleaning materials shall be appropriate to the surface and materials being cleaned.

B. Materials: Use only cleaning materials recommended by manufacturer of surface to be cleaned

C. Provide pads to protect finished surfaces from cleaning materials.

PART 3 - EXECUTION

3.01 PREPARATION

A. Post signs to advise building occupants if wet and/or slippery floor conditions exist during cleaning operations.

3.02 PROGRESS CLEANING

A. Keep all buildings, enclosures, and confined areas where work is being performed under the Contract free from unattended combustible materials.

B. Remove rust spots as they develop.

C. Execute daily cleaning to ensure that building, grounds, and public properties and roadways are maintained free from accumulations of waste materials, rubbish, dirt, mud and dust.

D. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

E. Each day, each contractor shall adhere to the following:

1. Areas of intense activity, such as cutting and sawing must be swept clean and reorganized at the end of each day. Utilize dust control methods such as plastic containment enclosures and/or wetting of surfaces.
2. Areas of moderate activity, such as installation of plumbing, ductwork, electrical work, must be returned to operating / safe order at the end of each day.
3. Debris below scaffolds including areas of shoring and re-shoring, must be kept sufficiently cleared and consolidated to keep walkways free of tripping hazards at all times. These work areas must also be swept clean immediately after removal of scaffolds, shoring, etc.
4. All swept up debris, waste materials, and packing must be removed and placed in a dumpster by the end of the workday.
5. All stored material must be protected and kept in good order.
6. As portions of the work are completed, all used and excess materials shall be removed promptly.
7. Daily Clean-up and good housekeeping is the responsibility of each contractor individually and will be monitored by the Owner's Construction Representative. If any contractor fails to perform cleaning when directed or does not properly clean within 4 hours of being notified by Owner's Construction Representative, the Owner will hire others and charge the responsible contractor accordingly.
8. Contractors shall promptly comply with requests to organize scattered materials.
9. Daily sweep and weekly damp mop of all work areas.

F. Each Contractor is responsible for furnishing dumpsters or other such containers as required for collection, storage and legal disposal of all debris and rubbish resultant from their individual construction operations (both demolition and daily construction debris). The Owner's Construction Representative shall direct contractors to locate, maintain and move such containers as necessary and legally dispose of waste as containers are filled. Each contractor shall separate and recycle waste as required by authorities, contract requirements and local regulations / ordinances.

G. The General Construction Contractor shall vacuum clean areas when ready to receive finish painting, and continue vacuum cleaning, on an as needed basis, until the building(s) is (are) ready for Substantial Completion.

H. Handle materials in a controlled manner to reduce handling to the extent possible. Do not drop or throw materials from heights.

I. Schedule cleaning operations so that dust and other containment resulting from cleaning process will not fall on wet, newly painted surfaces.

3.03 FINAL CLEANING

A. Remove dust, dirt, grease, stains, paint drips and runs, plastic, labels, tape, glue, rope, and other foreign materials from visible interior and exterior surfaces.

B. Do not move dust from spot to spot. Remove directly from the surface on which it lies by the most effective mean such as appropriately treated dusting cloths or vacuum tools. When doing high cleaning, do not allow dust to fall from high areas onto furniture and equipment below.

C. Dismantle and remove all temporary structures, scaffolding, fencing, and equipment. Remove waste materials, rubbish, lumber, block, tools, machinery, and surplus materials.

D. Perform the following prior to final payment:

1. Broom clean all exterior concrete surfaces and vacuum clean all interior concrete surfaces.
2. Dust and spot clean painted and vinyl covered walls.
3. Clean and polish all unpainted metal on doors such as trim, hardware, kickplates and doorknobs.
4. Vacuum clean carpets and mats.
5. Vacuum clean acoustic ceilings.
6. Repair, patch, and touch-up marred surfaces to specified finish and to match adjacent surfaces.
7. Remove foreign material from exterior masonry.
8. Replace all broken and scratched glass and mirrors.
9. Replace all damaged insect screens.
10. Wash and clean interior and exterior window surfaces. All glass shall be clean and free of dirt, grime, streaks and excessive moisture. Wipe drippings and other marks from windowsills, sashes and woodwork. Do not use windowsills in lieu of ladders.
11. Polish bright metal by damp wiping and drying with a suitable cloth. If a polished appearance is not thereby produced, apply appropriate metal polish.
12. Clean and polish all stainless steel surfaces, including control panels supplied under this Contract.
13. Clean furniture and equipment in accordance with manufacturers instructions.
14. Clean all paved roads, lots and drives which were paved as work under this Contract and all existing paved surfaces using a mechanical street cleaner.
15. Repair or repaint damaged pavement markings.
16. Vacuum and clean with a damp cloth light fixtures, including glass and plastic lenses, ceiling and wall mounted lights, cover panels, side panels, louvers, fixture frames and lamps.
17. Clean supply vents and exhaust grilles. Clean gutters and downspouts.
18. Remove all rust spots and stains from new and pre-existing concrete, painted surfaces, and all other surfaces.

19. Clean and polish all new toilet facilities constructed under this project.
20. Clean and disinfect all pre-existing toilet facilities that were entered upon and used by the Contractor during the project.
21. Replace damaged existing toilet fixtures, such as sinks, toilet bowls, urinals, and mirrors, with in-kind units if so directed by the Architect/Engineer.
22. Wash all existing floors that were in any way impacted by the construction operations.
23. Rake clean landscaped surfaces. Final mow all areas grassed and sodded during the work.
24. Inspect interior and exterior surfaces, and all work areas, to verify that the entire work is clean and ready for use by the Owner. The project will not be considered substantially complete until all final cleaning has been performed.
25. Polish all new handrail installed as work of this contract with a commercially available aluminum cleaner recommended by the railing manufacturer.
26. Clean dirt that has accumulated between grating and grating angles/supports.
27. Vacuum the inside of all control panels provided under this Contract after the panel has been wired.
28. Fill in all holes in concrete that remain after temporary handrail is removed. Non-shrink grout shall be used.
29. Elevators: Clean all interior surfaces of the car including hoistway doors and services of the corridors on the side of the elevator. Polish all bright metal surfaces. Clean and spray buff resilient tiles. Dust and damp wipe elevator cab doors, walls and bright work.
30. Magnet sweep all exterior lawn and walkway areas to ensure that stray nails / screws, etc. remain in lawn areas nor on walkways.

3.04 RUBBISH REMOVAL

A. A. Contractors shall comply with all Local, State and Federal Laws, Codes and Requirements regarding recycling and trash or rubbish removal.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work of this Section includes the following:
   1. Starting systems
   2. Testing, adjusting, and balancing
   3. Updating of manufacturer's operations and maintenance manuals and wiring diagrams

B. Work of this Section also includes stipulated man-hours that shall be provided by the **Prime Electrical Construction Contractor** for startup participation of equipment and systems.

1.02 STARTING SYSTEMS

A. The Contractor shall coordinate, schedule, and sequence the start-up of various equipment and systems.

B. Where the start-up of a system or piece of equipment is dependent upon the start-up of other system(s) or equipment, then the Contractor shall schedule and sequence the start-ups to coincide.

C. Notify the Architect/Engineer at least 14 calendar days prior to the start-up of each item or system so that he can schedule the startup with the Owner, utilities, and other Prime Contractors.

D. Where applicable, verify that each piece of equipment or system has been checked for proper:
   1. lubrication,
   2. drive rotation,
   3. belt tension,
   4. motor starter heater size,
   5. fuse size,
   6. water pressures,
   7. terminal connections,
   8. control sequence,
   9. for conditions which may cause damage or delay the start-up procedure.

E. Verify that the equipment has been installed in accordance with the manufacturer's requirements.

F. Complete all pre-startup checklists that may be required by the system vendor.
   1. In the event that start-up activities are delayed as a result of the Contractor's failure to properly check the completed installation and a manufacturer's representative is on the job site waiting for corrections to be made, then the Architect/Engineer may, at his/her sole discretion, postpone start-up until such time as the corrections have been made without any extra costs.
   2. The Owner may deduct from money due the Contractor the excess cost of engineering associated with having the Architect/Engineer present during the start-up.
   3. The deduction shall be equal to the Architect/Engineer's effective billing rate times the total number of hours delayed during the start-up activities.

G. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

H. Verify that wiring and support components for equipment are complete and tested.

I. Execute start-up under supervision of applicable Contractor's personnel in accordance with manufacturer's instructions.

J. The Contractor shall have the job site superintendent present during all start-up activities.

K. Provide manufacturer's authorized technician at the site when specified and in accordance with the requirements contained in Section 014500 - Quality Control.

L. Submit manufacturer's start-up reports (MSR's) in accordance with Section 013300.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 SUBMITTALS

A. Submit the following documents to the Architect/Engineer before Substantial Completion:
   1. Project Record Documents as specified in Section 017839 - {\t\#1000077}.
   2. Operations and Maintenance Manuals prepared in accordance with Section 017823 - {\t\#1000076} and be updated as a result of start-up activities.
   3. Manufacturer's Start-up Reports (MSR's) for all equipment and systems where manufacturer field time is specified.
      a. Each MSR shall be signed by the field technician(s) who attended the start-up.
      b. If the manufacturer is taking exception to the installation or if the warranty is voided, he shall provide a statement to that effect and provide reasons and justification to explain the company's position.
   4. One binder containing original counterparts of all warranties, guarantees, bonds, or affidavits as specified in the Technical Specification Sections. These documents shall contain the original signatures and be placed in a plastic sheet protector, one document per protector.
   5. Spare parts checklist itemizing all spare parts furnished under the Contract summarized by Section.
   6. Electrical Underwriter's Certificate where the prime construction contract includes electrical construction or where this Contract is for a Prime Electrical Construction Contract.

B. Submit the following items to the Architect/Engineer with the final application for payment:
   1. Final Application for Payment and continuation (G702 and G703)
   2. Contractor's Certified Payrolls
   3. OSHA cards for all workers
   4. Contractor's Affidavit of Payment of Debts and Claims (G706)
   5. Contractor's Affidavit of Release of Liens (G706A)
   6. Final list of Subcontractors (G705)
   7. Subcontractor's Affidavit of Payment of Debts and Claims (G706) - (for each subcontractor used)
   8. Subcontractor's Affidavit of Release of Liens (G706A) - (for each subcontractor used)
   9. Consent of Surety to Final Payment (G707)
   10. 2 year Maintenance Bond - 100% of contract including change orders
   11. Contractors letter guaranteeing workmanship 2 years
   12. Product data, Maintenance manuals and Warranty Information
   13. As Built Documentation
   14. Attic Stock / Spare Parts (provide proof of delivery transmittal signed by owner)
   15. Training and Demonstrations (provide sign-in from training session)
   16. Asbestos Affidavit and waste manifests

C. All documents shall be complete, signed, dated, and notarized (where applicable) and be subject to the Architect/Engineer's acknowledgment of receipt or approval.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies the requirements for Operations and Maintenance Manuals required to be prepared by system suppliers and equipment manufacturers.

B. The Contractor shall submit Operations and Maintenance Manuals for all equipment.

C. Where the technical specifications call for the submission of manuals, said manuals shall be prepared in accordance with the requirements contained herein. It being understood that manuals shall be submitted for all equipment even if it is not specifically called out in the specifications.

1.02 MANUAL CONTENTS AND FORMAT

A. All Operations and Maintenance Manuals shall be as specified hereinafter.

B. The binder shall be 8 1/2" x 11", metal hinge, vinyl, large capacity by National or Equal. It shall show the name of the manufacturer or supplier and project name on the spine of the binder.

C. A cover shall be provided showing the names of the Owner, Architect/Engineer, Contractor, and Manufacturer.

1. It shall show the Contractor's order number and manufacturer's project number.
2. The address of the manufacturer, service station telephone number, project title, contract number, and year shall also be shown.

D. Provide tabbed color dividers for each separate product and system.

1. The name of the product shall be typed on the tab.
2. A separate tab shall also be provided for information such as troubleshooting instructions, spare parts list, etc.

E. An index shall be provided in the back of the binder, with a separate tab, providing a quick way for the operator to find key and important topics contained in the manual.

F. A separate listing for all charts, graphs, tables, figures and shop drawings shall be provided directly following the table of contents.

G. Each manual shall contain one (1) copy of all shop drawings deemed in compliance with the Contract Documents by the Architect/Engineer submitted for the equipment or system for which the manual is prepared.

1. Only these shop drawings shall be included in the manual.
2. All shop drawings larger than 8 1/2" x 11" shall be folded and placed in a heavy duty, top loading plastic sheet protector with the title of the drawing showing; one (1) drawing per protector page.

H. For systems being furnished with control panels, each manual shall contain a catalog cut for every electrical device installed inside the control panel or motor control center.

I. Where emergency generator(s) are included as work of this Contract, the manufacturer's standard manual will be allowed if the manual clearly shows the instructions for the particular model of generator. Cross out chapters and paragraphs that do not apply to the Owner's generator.

J. Each manual shall contain the following as a minimum:

1. Table of contents
2. Final version of the warranty statement approved by the Architect/Engineer
3. Nameplate data of each component, year of installation, contract number and specification number
4. Name, address and telephone number of the manufacturer and the manufacturer's local representative(s)
5. Installation instructions
6. Operation instructions including adjustments, the interrelation of components and the control sequence describing break-in, start-up, operation and shutdown
7. Emergency operating instructions and capabilities
8. Maintenance requirements include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair and reassembly instructions; and alignment, adjusting, balancing, and checking instructions
9. Troubleshooting guide and corrective maintenance (repair) procedures for all electrical and mechanical equipment. These guides shall list the most frequent and common problems, together with the symptoms, possible causes of the trouble, and remedies
10. Drawings (pictures or exploded views) which clearly depict and identify each part, suitable for assembly and disassembly of entire system and each component
11. Wiring and control diagrams, if applicable
12. Panelboard circuit directories including electrical service characteristics, if applicable
13. Part list with current prices; ordering information; and recommended quantities of spare parts to be maintained in storage
14. Charts of valve tag numbers, with location and function of each valve, keyed to the process and instrumentation diagram prepared as part of the Contract Documents
15. Name, address, and telephone number of nearest parts supply house and nearest authorized repair service center.
16. List of recommended spare parts and the recommended number of each per unit and per group of units.

K. All electronic Operations and Maintenance Manuals shall be as specified hereinafter.

1. All files shall be in Adobe PDF format and submitted on compact discs.
2. Files shall be organized by specification section and then by product.
3. An electronic index and list of all charts, graphs, tables, figures, and shop drawings shall be included.
4. All information provided in the paper Operations and Maintenance Manual shall be included in the electronic version.

L. Submit two (2) copies of a preliminary draft manual at least fourteen (14) calendar days prior to the date set for start-up.

1. The Architect/Engineer will review the manual for content and compliance with these specifications.
2. Written comments will be provided, but the manual will not be returned.
3. One (1) manual will be used at start-up, to record changes that should be made to the final manual.

4. This copy of the manual will be retained on the site until such time as the final, updated manual is provided.

M. Two (2) weeks after the date the unit was placed into service and the Owner has gained beneficial use, submit five (5) copies of the final updated Operations and Maintenance Manual. Refer to Section 017500 - {\t\#1000073} for requirements related to updating the manual(s).

N. Where installation instructions are not included with the manual, they shall be shipped at least ten (10) days prior to the date the equipment is scheduled for installation.

1.03 RETAINAGE

A. The Architect/Engineer will retain from payment due the Contractor, for failure to submit manuals as specified, an amount equal to 2% of the scheduled value for the equipment or system for which the manual applies. This Contract requirement only applies when a manual is specified to be provided in the Technical Specifications for a particular system or piece of equipment.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 017823

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes:

1. Maintenance of documents
2. Recording of record information
3. Submission of record documents

1.02 PLANS AND SPECIFICATIONS FURNISHED TO THE CONTRACTOR

A. Two (2) complete sets of Contract Documents (plans, specifications and addenda) will be furnished to the Contractor.

1.03 MAINTENANCE OF DOCUMENTS

A. The Contractor shall maintain at the site one (1) set of the following: drawings, specifications, addenda, change orders, approved shop drawings, test reports, operation and maintenance manuals, and shop drawing log.

B. The Contractor shall make these documents available for use by the Owner, Architect/Engineer, regulatory agencies and other parties designated by the Owner.

C. Maintain these documents in a clean, dry, legible condition throughout the entire contract period.

1.04 RECORDING OF RECORD INFORMATION

A. Affix a stamp to each Contract Drawing and Shop Drawing reading as follows: "RECORD DOCUMENT" - "NAME OF PROJECT" - "CONTRACTOR NAME" in 2-inch high printed letters. The stamp shall be specifically prepared for this project.

B. Keep the record documents current as the work progresses. Record information concurrent with construction progress.

C. Shop Drawings: Maintain as record documents. Legibly mark-up to show changes made due to field conditions encountered during construction.

1.05 PROJECT RECORD DOCUMENTS

A. Maintain a complete and accurate log of control and survey work as it progresses.

1.06 SUBMITTAL OF RECORD DOCUMENTS

A. At Substantial Completion, the Contractor shall deliver one (1) preliminary record set of as-built documents to the Architect/Engineer with all changes conspicuously ballooned or otherwise emphasized.

B. The work will not be considered substantially complete until such time as the preliminary record documents are delivered and acceptable to the Architect/Engineer. Mark this set "Preliminary Record Drawings".

C. Prior to Final Completion, the Contractor shall conform the preliminary record drawings to the comments made by the Architect/Engineer. The Contractor shall provide one (1) set of full-scale paper as-built drawings and one (1) electronic copy in portable document format (PDF).

D. As-built drawings shall be the same size as the Contract Drawings, with 1/2-inch margins space on three sides and a 2-inch margin on the left side for binding.

E. Each drawing shall bear in the title box the words "FINAL RECORD DRAWINGS" and the name of the Contractor in heavy black lettering 1/2 inch high and be certified as complete and accurate.

F. As a convenience, Architect/Engineer will make available to the Contractor electronic media of the Contract Drawings for the sole purpose of the Contractor preparing as-built drawings.

G. Electronic media made available is without guarantee of compatibility with the Contractor's software or hardware.

1. If the Contractor wishes to take advantage of this offer, the Contractor will be required to execute an indemnification and hold harmless agreement with the Architect/Engineer.

1.07 RELATED DOCUMENTS

A. Provide certificate of release of liens if requested by the Architect/Engineer.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Section includes the requirements for delivering spare parts specified to be furnished under the provisions of the Contract Documents.

1.02 QUALITY ASSURANCE

A. Spare parts shall be delivered as complete assemblies direct from the manufacturer such that the part is fully functional and ready to be installed.

1.03 DELIVERY, STORAGE AND HANDLING OF SPARE PARTS

A. Comply with the requirements of Section 016500 for packing, delivery, storage and handling requirements for all parts delivered to the site of the work.

B. All spare parts required to be furnished under a Section of the Specifications shall be packaged in one separate box, crate or container with the words "SPARE PARTS" lettered on all sides of the container.

C. The equipment name or system name for which the spare parts are being provided shall also be lettered on the container.

D. A separate packing list for the spare parts shall be included in the container.

E. The Contractor shall store all spare parts indoors immediately upon delivery of the spare parts to the site. Spare parts will not be accepted by the Owner/Architect/Engineer if the spare parts have been stored outdoors for more than 8 hours upon delivery to the site.

F. The storage location shall be secure.

1.04 TURN OVER OF SPARE PARTS

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work of this Section includes the requirements for demonstrating and training of installed systems, equipment, and products.

B. Manufacturer field services and the credit for unused service time is also included herein.

1.02 MANUFACTURER'S FIELD SERVICES

A. When specified in individual specification sections require field services to be provided, said services shall be provided by qualified, authorized and factory trained representative(s) of the manufacturer (supplier).

B. Field services shall generally consist of:

1. installation supervision,
2. verify terms of the manufacturer's warranty,
3. equipment and system calibration,
4. startup supervision,
5. and operation and maintenance instructions to the Owner's employees.

C. Such services do not include service time to correct a factory fault, correct problems resulting from a factory wiring or control logic error, or errors caused by poor or improper installation by the Contractor.

D. The time specified to be provided under the specification sections shall be exclusive of travel time to and from the facility or site. For the purposes of this Contract, one (1) day shall be defined as eight (8) hours exclusive of breaks or mealtime.

E. The times specified to be provided by the manufacturer does not relieve the manufacturer from providing sufficient service time to place the equipment or systems into satisfactory operation and to obtain the specified performance. The manufacturer shall provide, as a minimum, the times specified in the Specification Sections.

1.03 SUBMITTALS

A. The Contractor shall prepare a list of all manufacturer specified field time required by the technical specifications. Compile this summary listing and submit it to the Engineer for review in accordance with the requirements contained in Section 013300 - {\t\#1000058}.

B. Manufacturer's Startup Reports

1.04 QUALITY CONTROL

A. The Contractor shall adhere to all instructions provided by the manufacturer's authorized representative.

B. All verbal instructions necessary to satisfy performance of the equipment or the system shall be immediately provided by the Contractor. The manufacturer shall document all verbal orders in writing at a time suitable to the Contractor.

C. All written instructions provided in operation, maintenance, and installation guides and manuals, provided by the manufacturer of such equipment and or system, shall be complied with by the Contractor.

D. The Contractor shall comply with all manufacturer requirements such that written or implied warranties remain in full force during the time period so specified elsewhere in the technical specifications.

E. Should manufacturer's instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

F. Actions and/or non performance by the Contractor that may void manufacturer warranties shall not constitute a release of the specified warranty, and all warranty claims made by the Owner shall be paid for by the Contractor as if the manufacturer's warranty was still in effect.

1.05 SCHEDULING - FIELD SERVICES

A. The Contractor shall arrange field service on dates acceptable to the Owner and Architect/Engineer.

B. The service visits shall be scheduled at least 2 weeks in advance so that the Owner and Architect/Engineer can adequately staff the date.

C. Operator training will not be allowed until such time as the Manufacturer's Operation and Maintenance Manuals have been supplied and approved by the Architect/Engineer.

1. The field service technician shall review the contents of the manual with designated employees of the Owner.
2. Field services will not be deemed provided until the MSR is provided.

1.06 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel prior to date of Substantial Completion.

B. Utilize manufacturer's and vendor's Operation and Maintenance Manuals as basis for instruction. Review contents of the manual with the Owner's personnel in detail to explain all aspects of operation and maintenance.

C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of the equipment or of the system.

D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

E. The Contractor shall arrange to have the manufacturer's Operation and Maintenance Manuals updated with information that has been added during start-up activities.

F. The final manual shall contain the most recent information and reflect all operational and maintenance aspects of the final installed and functioning system or equipment component of the system.

G. Any changes to control panel wiring diagrams or interconnection wiring schematics shall be made and new prints provided as an update to previously approved manuals.

H. Manufacturer field time shall be as specified in individual Sections of the Technical Specifications.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. 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.
   4. Recovery of Refrigerant materials.

B. Related Requirements:
   1. Section 011100 - SUMMARY OF WORK for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
   2. Section 311000 - {\t\#1000088} for site clearing and removal of above- and below-grade improvements.

1.03 DEFINITIONS

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

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.04 MATERIALS OWNERSHIP

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

1.05 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.
   6. Review procedures for turning over salvaged materials to the Owner and protected off-site storage of materials to be reused in the work of the project.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting the public, pedestrian access and circulation areas and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

C. 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.

D. Inventory: Submit a list of items to be removed, salvaged and delivered to Owner prior to start of demolition.

E. Pre-demolition Photographs and/or Video: Show existing conditions of adjoining existing construction and site conditions, including finish surfaces that could potentially be construed as having been damaged by Demolition activities. Submit two copies prior to commencing Demolition work.

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 indicated that existing warranties are still in effect after completion of selective demolition.

1.07 CLOSEOUT SUBMITTALS

A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.08 QUALITY ASSURANCE

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

1.09 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.

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

D. Hazardous Materials: Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use and is included in this Division of the specifications. Examine report and / or the appropriate specification section 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. Storage or sale of removed items or materials on-site is not permitted.

F. 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.
2. Provide a Fire Watch or other method acceptable to the authority having jurisdiction should the existing fire protection facilities have to be shut down during the work.
3. Do not disable or disrupt building fire or life safety systems without five (5) days prior written notice to Architect.

1.10 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials 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.

PART 2 - PRODUCTS

2.01 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/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.01 EXAMINATION

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

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. 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.

F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.
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.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

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

1. Comply with requirements for existing services/systems interruptions specified in Section 011100 - SUMMARY OF WORK.

B. Existing Services/Systems to be removed, relocated, or abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off indicated utilities with utility companies. Provide 5 days notice to the Architect prior to any utility shut-downs.
2. 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.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap, plug or reconnect remaining piping with same or compatible piping material.
b. Equipment to Be Removed: Disconnect and cap services and remove equipment.
c. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug or reconnect remaining ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.03 PREPARATION

A. 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.
1. Comply with requirements for access and protection specified in Section 015000 - TEMPORARY FACILITIES AND CONTROLS.

B. Temporary Facilities: 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. Maintain existing required widths of egress pathways throughout.
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.

C. Temporary Shoring: 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.

3.04 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, to minimize disturbance of adjacent surfaces. 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 fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. 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.

3.05 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 1 inch (25 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. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

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

D. 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.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

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.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.07 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.

3.08 SELECTIVE DEMOLITION SCHEDULE

A. Remove, store, relocate, salvage and protect the following materials and equipment:
   1. Existing Items to Be Removed: Items indicated on contract drawings and items listed in technical specifications sections.
   2. Existing Items to Be Removed, relocated and/or Salvaged: Items required to be removed, relocated salvaged and/or stored to complete the work as indicated or called for in these construction documents.

B. Existing Items to Remain: to complete and conform to the work of the project shall be as indicated on the contract drawings and items listed in the technical specification sections.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Underslab vapor retarder.

1.03 REFERENCES

A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

C. ACI 301 - Specifications for Concrete Construction; 2020.

D. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

F. ACI 305R - Guide to Hot Weather Concreting; 2020.

G. ACI 306R - Guide to Cold Weather Concreting; 2016.

H. ACI 308R - Guide to External Curing of Concrete; 2016.

I. ACI 318 - Building Code Requirements for Structural Concrete; 2019, with Errata (2021).

J. ACI 347R - Guide to Formwork for Concrete; 2014 (Reapproved 2021).

K. ASTM A184/A184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement; 2019.

L. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

M. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2022.

N. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2022.

O. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

P. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2021.
Q. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2022.
R. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
S. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.
T. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2017.
U. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.
V. ASTM C192/C192M - Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory; 2019.
W. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).
X. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.
Y. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).
Z. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2022.
AA. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars; 2024.
BB. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2021.
CC. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete; 2010a (Reapproved 2015).
DD. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2020.
EE. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction; 2012 (Reapproved 2017).
FF. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2018.
GG. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting; 2015.
HH. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications; 2016.
II. ASTM E1155/E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2023.
JJ. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.

KK. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs; 2017.

LL. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars; 2018, with Amendment (2020).

MM. PS 1 - Structural Plywood; 2009 (Revised 2019).

NN. ACI 350 - Concrete Sanitary Engineering Structures.

OO. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

1.04 ACTION SUBMITTALS

A. The contractor shall comply with the requirements of Division 01 Specification of the Project Manual, Section 013300 - SUBMITTALS.

B. Product Data: For each type of product indicated.

C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.
2. Submit mix design mixtures for each type of concrete to be used on the Project at least 30 calendar days prior to the first scheduled concrete pour. The Contractor's testing laboratory shall develop concrete mix designs and test all materials and mixes for conformance with ACI 301 and these specifications. The costs associated with development of the design mix and testing of samples shall be included in the bid price.
3. Submit the following:
    a. Name, address, and telephone number of Contractor's laboratory.
    b. Mix proportions.
    c. Source of cement, type, brand, and certified copies of mill reports, including physical and chemical analysis.
    d. Sources of fine aggregates and results of test made in accordance with ASTM C33/C33M and ASTM C40.
    e. Source of coarse aggregates and results of tests made in accordance with ASTM C33/C33M.
    f. Catalog cuts of all admixtures.
    g. Furnish test results of slump, air entrainment and water-cement ratio for each mix design.
4. For each mix proposed, make and cure four (4) standard 6 inch concrete test specimens to the laboratory in accordance with ASTM C192/C192M. Furnish compression test results made in accordance with ASTM C39/C39M. Break two (2) cylinders at seven (7) days and two (2) at 28 days.
5. If the concrete is intended to be pumped, design mix accordingly and submit certification that it has been tested for pumping.
6. If adopted mix fails to produce concrete meeting the requirements for strength and placibility, the Architect may order additional cement or adjustments to mix proportions at no extra cost to the Owner.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, spacing, locations, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement including steel bars and wire fabric.

E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer licensed in the state where the project is located; detailing fabrication, assembly, and support of formwork. Shop drawings shall bear the signature and seal of the same licensed Professional Engineer.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal
2. Shop drawings shall indicate formwork dimensioning, materials and arrangement of joints and ties.
3. Manufacturer's instructions: Indicate installation procedure and interface required with adjacent work

F. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect, if not shown on the drawings.

G. Samples: For waterstops, vapor retarders, and vapor retarder tape.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Welding certificates.

C. Material Certificates: For each of the following, provided by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Curing compounds.
6. Adhesives and Vapor retarders.
7. Semi rigid joint filler.
8. Joint-filler strips.

D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

E. Field quality-control reports.

F. Minutes of preinstallation conference.

G. Furnish transit-mix delivery slips to Owner's Representative.

1.06 QUALITY ASSURANCE

A. Comply with Referenced Standards specified in Division 01 Section "References" in addition to ACI 301.

B. Perform testing under the provisions of Division 01 Section "Quality Requirements" and the "FIELD QUALITY CONTROL" Article of Part 3 listed in this specification.

C. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

D. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

E. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1. The contractor shall provide an adequately sized, insulated curing box to house concrete cylinders at the discretion of the Architect, for the 48-hour period between concrete pour and sample collection pick-up by the Testing Laboratory (ASTM C31/C31M). As directed by the Architect, the contractor shall cure additional cylinders in the same fashion as the in-place concrete.
2. Curing box shall be located away from the main construction area and shall be blocked up off the ground.
3. A log sheet shall be provided in a waterproof sheet protector to log in the placement and removal of the concrete test samples by the testing laboratory.
4. Minimum information to be logged for each pour date shall include: date of pour, date of pick-up, weather conditions at the time of pour, testing

F. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer. To further insure consistency, coloration, finish and quality; all aggregates, cement, water and other ingredients shall each be secured from the same source for the duration of the project.

1. The batching plant and raw materials may be subject to inspections and test performed by the Architect.

G. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

H. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete", Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials".
3. ACI 304R - "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".

I. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

B. Store cement off the ground in a dry, weatherproof, adequately ventilated structure with provisions to prevent the absorption of water.

C. Transport dry concrete batches from the central plant to the site in approved truck mixers conforming to the requirements of the Truck Mixer Manufacturer's Agitating Standards. Each truck shall contain a plate stating the capacity, drum speeds and be provided with a revolution counter.

D. Packaged material shall be delivered and stored in the original packages until ready for use. Packages or materials showing evidence of water or other damage shall be rejected.

E. Protect all materials from freezing.

1.08 COORDINATION

A. Coordinate work under provisions of Division 01 Specification of this Project Manual.

B. The Contractor shall provide at least five (5) working days advance notice prior to formwork closure to the Architect.

C. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

D. Notify Architect a minimum of three (3) working days prior to commencement concrete pours.

1.09 REGULATORY REQUIREMENTS

A. Conform to ACI 304R and all applicable codes for placement of concrete and related work.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when the ambient temperature is below 40 deg. F. or when the concrete temperature exceeds 85 deg. F. Under certain circumstances, the Engineer may approve the placement of concrete under the above conditions, provided that the procedures of ACI 305R and ACI 306R are strictly adhered to.

B. Do not place concrete when the conditions may adversely affect the placing, curing or finishing of concrete, or its strength.

C. Comply with the requirements contained in Section 016500 - {\t\#1000031}.

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
   2. Steel forms: Minimum 16 gage thick, stiffened to support weight of concrete with minimum deflection.
   3. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. Douglas Fir Species, solid one side grade and sound

B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum unless indicated otherwise on the drawings.

C. Form-Release Agent: Commercially formulated, colorless, water based, non-toxic, V.O.C. compliant, environmentally safe material which will not stain concrete, absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete; manufactured by DAYTON SUPERIOR or equal. Agent shall not be detrimental to the environment.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Steel Bar Mats: ASTM A184/A184M, fabricated from ASTM A615/A615M, Grade 60 ; ASTM A706/A706M, deformed bars, assembled with clips.

2.03 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
   2. Provide load bearing pad on bottom to prevent vapor barrier puncture.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel

wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. Provide load bearing pad on bottom to prevent vapor barrier puncture.

2.04 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C150/C150M, Type IA, gray. Supplement with the following:
   a. Fly Ash: ASTM C618, Class F or C.
   b. Ground Granulated Blast-Furnace Slag: ASTM C989/C989M, Grade 100 or 120.
2. Silica Fume: ASTM C1240, amorphous silica.
3. Normal-Weight Aggregates: ASTM C33/C33M, No. 57 or 67 crushed stone coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   a. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
   b. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
4. Water: ASTM C94/C94M, clean and not detrimental to concrete.

2.05 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260/C260M.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017, Type II.

2.06 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E1745, Class C or polyethylene sheet, ASTM D4397 not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, provide the following:
   a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400
   b. Grace Construction Products, W. R. Grace & Co.; Florprufe 120
   c. Insulation Solutions, Inc.; Viper VaporCheck 10.
   d. Meadows, W. R., Inc.; Perminator 10 mil.
   e. Reef Industries, Inc.; Griffolyn 10 mil Green.
   f. Stego Industries, LLC; Stego Wrap 10 mil Class A.
   g. Or approved equal.

B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C33/C33M for fine aggregates.
   1. Depth Requirements:
      a. Slab on grade: 6 inches (unless otherwise noted in the Geotechnical Report).
      b. Footings: 12 inches (unless otherwise indicated in the Geotechnical Report).

2.07 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing No. 4 sieve.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dayton Superior Corporation; Emery Tuff Non-Slip
      b. Lambert Corporation; EMAG-20
      c. L&M Construction Chemicals, Inc.; Grip It
      d. Metalcrete Industries; Metco Anti-Skid Aggregate

2.08 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 8 oz. /sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet weighing approximately 8 oz. / sq. yd. bonded to prevent separation during use.

C. Membrane curing compound: Moisture Retention complying with ASTM C309. Products: EUCOCURE VOX by Euclid Chemical Company or equal.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.
   1. Products: Eucocure VOX as manufactured by Euclid Chemical Company or approved equal.

2.09 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, 1/2" asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: three-component, solvent-free, moisture tolerant, epoxy modified cementitious product.
   1. Product: Armatec 110 EpoCem as manufactured by Sika Corporation or specifically approved equal.
   2. Types I and II, non-load bearing Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Non-Shrink Grout: Premixed compound, free of chlorides, with non-metallic aggregate, cement water reducing and plasticizing agents; capable of minimum compressive strength of 2400 psi at 48 hours and 7000 psi at 28 days. Grout shall be suitable for contact with potable water. For equipment bases and pipe supports, use non-shrink grout by Master Builders, Embeco 636, Unisorb V-1 or equal.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 211.1 and ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
   1. Fly Ash: 25 percent.
   2. Combined Fly Ash and Pozzolan: 25 percent.
   3. Ground Granulated Blast-Furnace Slag: 50 percent.
   4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent Portland cement minimum, with fly ash or Pozzolan not exceeding 25 percent.
   5. Silica Fume: 10 percent.
   6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
   7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
   8. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

C. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: Pier, Mat and Spread Footings; foundation walls, slab on grade and slab on metal deck: 4000 psi at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.50 for all concrete building elements.
   3. Slump Limits (Conventional Mix):
      a. Slabs: 3 inches plus or minus one inch.
      b. Piers, Foundation Walls and Footings: 4 inches plus or minus one inch.
   4. Slump Limits (Pump Mix):
      a. Final slump (Slabs): 6 1/2 inches plus or minus one inch.
      b. Final Slump (Foundation, walls and footings): 7 1/2 inches plus or minus one inch

5. Air Content:
   a. Piers, Mats and Spread Footings: 5.5 percent, plus or minus 1.0 percent. at the point of delivery.
   b. Slabs: 3 percent, plus or minus 1.0 percent at point of delivery. Do not allow air content of trowel finished concrete floors to exceed 3 percent.
6. Large Aggregates: 3/4" crushed stone; ASTM C33/C33M, No. 67.
7. Use Admixtures only when approved by the Engineer.
8. Mix Grout in accordance with the manufacturer's instructions and specifications.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and measurements before proceeding with formwork. Ensure that dimensions agree with the plans.

B. Inspect the formwork and reinforcing that it has been properly set and secured and that all items to be embedded, built-in or pass through concrete are at their proper locations and elevations.

C. The General Construction Contractor shall verify that all other prime contractors have installed concrete inserts, sleeves, and embedded elements of the project, such as conduit, and their work has been totally completed and inspected by the Architect.

D. Ensure that all points of contact with new grout are free from oil, grease and scale.

3.02 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces.
   2. Class B, 1/4 inch for rough-formed finished surfaces.
      a. Hand trim sides and bottom of earth forms and remove loose soil to the satisfaction of the Architect.
      b. Remove water from forms and excavations and divert water flow to avoid washing over, under or though freshly placed concrete.

D. Construct forms tight enough to prevent loss of concrete mortar. Align form joints.

E. Do not apply form release agent where concrete surfaces are to receive special finishes or applied coatings that may be affected by the agent.

F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer: Provide 3/4" inch chamfer on all exterior horizontal and vertical corners and edges of permanently exposed concrete.

J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement. Do not apply form release agent where concrete surfaces are to receive special finishes or applied coatings that may be affected by the agent.

N. Where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack with non-metallic/ non-shrink grout.

O. Prepare previously placed concrete by cleaning with steel brush and apply a Bonding Agent in accordance with the manufacturer's specifications and instructions.

3.03 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Ensure that all inserts and embedded items are not disturbed during concrete placement.

3.04 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.05 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E1643 and manufacturer's written instructions.
   1. Lap joints 6 inches and seal with manufacturers recommended tape.

B. Granular Course: Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

3.06 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars. Use reinforcing splices at minimum of locations and only at locations of

minimum stress. Review locations of splices with Architect. Splice locations shall be approved during shop drawing review phase. Rebar splice overly shall be the minimum length as per ACI 318.

1. Weld reinforcing bars according to AWS D1.4/D1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced t minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Take necessary measures to ensure that reinforcement is not disturbed during the placement of concrete.

3.07 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated or at 20' o.c. maximum. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction / Control Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 3/16"-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section {\id\#1000071} - {\t\#1000071} are indicated.

3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

F. Ensure joint fillers and devices are not disturbed during placement of concrete.

G. Install all joint fillers and devices in accordance with the manufacturer's instructions and specifications for floor and wall finish.

H. Install joint device anchors. Maintain correct position to allow joint cover flush with floor and wall finish.

I. Install joint covers in one-piece length when adjacent construction activity is complete.

J. Apply sealants in joint devices in accordance with the manufacturer's specifications and instructions.

3.08 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
2. Place concrete with the aid of mechanical vibrators which are capable of transmitting to the concrete not less than 3,000 impulses per minute. Maintain at least three (3) vibrators in good working condition, ready for use when concrete placement begins in any one area.
3. Do not interrupt successive placement. Do not permit cold joints to occur.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and ACI 305R and as follows:

1. Maintain concrete temperature below 95 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
3. Maintain records of concrete placement. Record date, locations, quantity, air temperature and test samples taken.
4. In areas with floor drains, maintain floor elevations at walls; pitch surfaces uniformly to the drains maintaining a 1% slope.
5. Cure floor surfaces in accordance with ACI 308R.
6. Apply curing compound in accordance with the manufacturer's specifications and instructions in two (2) coats with the second coat at right angles to the first.

3.09 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch 6 mm in one direction.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, and ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E1155/E1155M, for a randomly trafficked floor surface:
    a. Specified overall values of flatness, F (F) 30; and of levelness, F (L) 20; with minimum local values of flatness, F (F) 24; and of levelness, F (L) 15; for suspended slabs.
3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft. long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. This surface shall be used for interior and exterior walking surfaces unless noted otherwise. Finish edges of exterior walkway flags with steel tooled radius edge.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, equipment pads, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb. /100 sq. ft. of dampened slip-resistive over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aluminum granules.

3.10 MISCELLANEOUS CONCRETE ITEMS

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

B. All exposed horizontal and vertical wall and slab corners shall have a ¾” wide chamfered edge.

3.11 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 and ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308R and ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

F. Liquid sealer/hardener to be applied on exposed concrete cured with moisture retentive or absorptive covers. The following materials provide varying levels of protection, sealant and hardness. Review products for project appropriateness.

1. Euclid: Euco Diamond Hard (Liquid Sealer and Hardener)
2. L&M Construction Chemicals: Seal Hard (Liquid Sealer and Hardener)
3. Curecrete Chemical Company: Ashford Formula (Liquid Sealer and Hardener)
4. Midwest Floor Care: Structure Formula (Liquid Sealer and Hardener)
5. Or approved equal.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least three month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

B. Immediately remove all rust spots that have developed during the construction period as soon as directed by the Architect. Remove all rust spots that have formed by the use of temporary handrails.

3.14 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and/or qualified testing and inspecting agency to perform field tests and inspections and prepare test reports. Contractor is responsible to notify the Owners representative at least 72 hours prior to the scheduled work that requires inspection / testing. The presence of the Inspector engaged by the Owner does not relieve the contractor of Quality Control Requirements.

B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:
   1. Steel reinforcement placement.
   2. Headed bolts and studs.
   3. Steel reinforcement welding.
   4. Concrete placement, including conveying and depositing.
   5. Curing procedures and maintenance of curing temperature.
   6. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
      a. Frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
      b. One (1) additional test cylinder shall be taken during cold weather and be cured under the same conditions as the concrete it represents.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C173/C173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C31/C31M.
    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure two Insert number sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C39/C39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7 and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Architect.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E1155/E1155M within 72 hours of finishing.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

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

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: Signed by manufacturers of underlayment and floor-covering systems certifying that products are compatible.

1.05 QUALITY ASSURANCE

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

B. Product Compatibility: Manufacturers of underlayment and floor-covering systems certify in writing that products are compatible.

C. Fire-Resistance Ratings: Where indicated, provide gypsum-cement underlayment systems identical to those of assemblies tested for fire resistance per ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

D. Sound Transmission Characteristics: Where indicated, provide gypsum-cement underlayment systems identical to those of assemblies tested for STC and IIC ratings per ASTM E90 and ASTM E336 by a qualified testing agency.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.07 PROJECT 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 gypsum-cement-based underlayment only when ambient temperature and temperature of substrates are between 50 and 80 deg F (10 and 27 deg C).

1.08 COORDINATION

A. Coordinate application of underlayment with requirements of floor-covering products and adhesives, to ensure compatibility of products.

PART 2 - PRODUCTS

2.01 GYPSUM-CEMENT-BASED UNDERLAYMENTS

A. Underlayment: Gypsum-cement-based, abrasion abrasion resistant, fast drying, self-leveling product that can be applied in minimum uniform thickness of 1/8 inch to a maximum of three inches and that can be feathered at edges to match adjacent floor elevations.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Maxxon Corporation: Commercial Topping
      b. ACG Materials; Accucrete: www.acgmaterials.com/#sle.
      c. ARDEX Engineered Cements; ARDEX K 22 F with ARDEX P51 Primer: www.ardexamericas.com/#sle.
      d. Hacker Industries, Inc; Firm-Fill 2010+: www.hackerindustries.com/#sle.
      e. Bonsal American, an Oldcastle company; ProSpec Level Set G
   2. Cement Binder: Gypsum or blended gypsum cement as defined by ASTM C 219.
   3. Compressive Strength: Not less than 3,200 psi at 28 days when tested according to ASTM C472
   4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.
   5. Material shall meet requirements of ASTM F710, "Preparing Concrete to Receive Resilient Flooring", where applicable.

B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; or coarse sand as recommended by underlayment manufacturer.
   1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

C. Water: Potable and at a temperature of not more than 70 deg F (21 deg C).

D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance.
   1. Proceed with application only after unsatisfactory conditions have been corrected.

3.02 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 F1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of Insert value in 24 hours.

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

D. Sound Control: Install sound control materials according to manufacturer's written instructions.
   1. Do not install mechanical fasteners that penetrate through the sound control materials.

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

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

C. Apply underlayment to produce uniform, level surface.
   1. Apply a final layer without aggregate to product surface.
   2. 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. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.04 PROTECTION

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

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Concrete masonry units.
   2. Architectural concrete masonry units.
   3. Mortar and grout.
   4. Cleaning of masonry.

1.03 DEFINITIONS

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

1.04 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.
   1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 402/602.
   2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C1314.

B. Fire Rated Assemblies: Tested in accordance with ANSI/UL 263 "Fire Tests of Building Construction and Materials" conforming to UL Assembly No. U906 .

1.05 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
   1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C140/C140M for compressive strength.
   2. Mortar Test (Property Specification): For each mix required, according to ASTM C109/C109M for compressive strength, ASTM C 1506 for water retention, and ASTM C91/C91M for air content.
   3. Mortar Test (Property Specification): For each mix required, according to ASTM C780 for compressive strength.
   4. Grout Test (Compressive Strength): For each mix required, according to ASTM C1019.
   5. Prism Test: For each type of construction required, according to ASTM C1314.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

C. Samples for Initial Selection:
   1. Architectural CMUs, in the form of small-scale units.
   2. Colored mortar.
   3. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:
   1. Exposed CMUs.
   2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
   3. Accessories embedded in masonry.

1.07 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
   1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:
   1. Masonry units.
      a. Include data on material properties material test reports substantiating compliance with requirements.
      b. For masonry units, include data and calculations establishing average net-area compressive strength of units.
   2. Cementitious materials. Include brand, type, and name of manufacturer.
   3. Pre-blended, dry mortar mixes. Include description of type and proportions of ingredients.
   4. Grout mixes. Include description of type and proportions of ingredients.
   5. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
   2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 402/602.

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

1.08 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C1093 for testing indicated.

B. In accordance with the Statement of Special Inspections, the Special Inspector shall provide, and coordinate inspections and verifications as noted on Contract Drawings.

C. Special Testing Inspections: Owner shall employ a Special Inspection Agency to provide required inspections in accordance with current Building Code of New York State.

D. The Special Inspector shall submit copies of reports to Architect, Engineer, Owner's Site Representative and Contractor on day that tests are made. Include date of testing, weather conditions, building location and test location.

E. 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.

F. 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.

G. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 402/602 unless modified by requirements in the Contract Documents.

1. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.
2. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2022.
3. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.
4. ASTM C476 - Standard Specification for Grout for Masonry; 2020.
5. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2020.
6. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C with a Vitreous Silica Dilatometer; 2016.
7. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.
8. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2020.
9. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

H. Mock-up Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014500 - QUALITY CONTROL for mockups.

1. Build sample panels for typical exterior wall in sizes approximately 72 inches long by 48 inches high by full thickness.
2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
3. Protect approved sample panels from the elements with weather-resistant membrane.
4. Approval of sample mock-up panel is for the following items:

a. Color, texture, and blending of masonry units;
b. Relationship of mortar and sealant colors to masonry unit colors;
c. Tooling of joints;
d. Aesthetic qualities of workmanship;
e. Other material and construction qualities specifically requested by Architect in writing.

5. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

1.09 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 pre-blended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and 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.

1.10 PROJECT 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.

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 ACI 530.1/ASCE 6/TMS 402/602.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 402/602.

PART 2 - PRODUCTS

2.01 MASONRY UNITS, GENERAL

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

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.02 CONCRETE MASONRY UNITS

A. Regional Materials: CMUs shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of the Project site.

B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide bullnose units for outside corners unless otherwise indicated.

C. Integral Water Repellent: Provide units made with integral water repellent for exposed units and where indicated.
   1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
      a. Products : Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
         1) ACM Chemistries, Inc.; RainBloc.
         2) BASF Group; MasterPel 240
         3) Grace Construction Products, W. R. Grace & Co.; Dry-Block.

D. CMUs: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi(19.3 MPa).
2. Density Classification: Normal weight.
3. Size: Manufactured to dimensions 3/8 inch less than nominal dimensions. Provide in sizes indicated on the drawings.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample or as indicated on the drawings.
5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

E. Architectural CMUs: ASTM C90.

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. Barrasso & Sons, Inc.
   b. A. Jandris & Sons, Inc.
   c. Palumbo Block Co., Inc.
   d. Architect approved equivalent.
2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi.
3. Density Classification: Normal Weight
4. Size: Manufactured to dimensions 3/8 inch less than nominal dimensions. Provide units; 8 inches by 16 inches (Nominal) / 7 5/8 inches by 15 5/8 inches (Actual) and As indicated on the drawings.
5. Thickness: 8 inches (Nominal) / 7 5/8 inches (Actual)
6. Pattern and Texture:
7. Colors: As selected by Architect from manufacturer's full range integral through body coloring.
8. Water Repellant: Integral Water Repellent.

2.03 MORTAR AND GROUT MATERIALS

A. Regional Materials: Aggregate for mortar and grout, cement, and lime shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Portland Cement: ASTM C150/C150M, 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.

C. Hydrated Lime: ASTM C207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.

E. Masonry Cement: ASTM C91/C91M.

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. Essroc, Italcementi Group; Brixment or Velvet.
   b. Holcim (US) Inc; Mortamix Masonry Cement.
   c. Lafarge North America Inc.; Magnolia Masonry Cement.
   d. Lehigh Cement Company; Lehigh Masonry Cement.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
   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. Davis Colors; True Tone Mortar Colors.
      b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
      c. Solomon Colors, Inc.; SGS Mortar Colors.

G. Colored Cement Product: Packaged blend made from Portland cement and hydrated lime or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

H. Aggregate for Mortar: ASTM C144.
   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 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.

I. Grout: ASTM C476. 2,000 psi minimum
   1. Fine aggregate: sand.
   2. Coarse aggregate: 3/8" chip gravel

J. Aggregate for Grout: ASTM C404.

K. Cold-Weather Admixture: Non-chloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
   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. Euclid Chemical Company (The); Accelguard 80.
      b. Grace Construction Products, W. R. Grace & Co.; Morset.
      c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

L. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs, containing integral water repellent by same manufacturer.
   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. ACM Chemistries, Inc.; RainBloc for Mortar.
      b. BASF Aktiengesellschaft; MasterPel 240MA Mortar Admixture.
      c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

M. Water: Potable.

2.04 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).

B. Masonry Joint Reinforcement, General: ASTM A951/A951M.
   1. Interior Walls: Mill- galvanized, carbon steel.
   2. Exterior Walls: Hot-dip galvanized, carbon steel.
   3. Wire Size for Side Rods: 0.187-inch diameter.
   4. Wire Size for Cross Rods: 0.148-inch diameter.
   5. Wire Size for Veneer Ties: 0.187-inch diameter.
   6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
   7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.05 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
   1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A153/A153M, Class B-2 coating.
   2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
   3. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Partition Top anchors:
   1. PTA type, Model 420 by Hohmann & Barnard, Inc. or approved equal, 0.105-inch thick metal plate with 3/8-inch diameter stainless steel rod, Type 304, 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Use in conjunction with NS Neoprene Sponge to allow for vertical expansion and contraction.
   2. PTA type, Model 422, by Hohmann & Barnard or approved equal, 12 gauge thick with 7/16 inch holes. Fabricate from steel, Hot-dip galvanized after fabrication. Use in conjunction with NS Neoprene Sponge to allow for vertical expansion and contraction.
   3. PTA Type, Model 364, by Hohmann & Barnard or approved equal, 12 gauge by 7 inches long (T-shape to engage Gripstay Channel), Type 304 Stainless Steel with PTA Rectangular Clear Butyrate Tube, ASTM D696, with compressible filler to allow for vertical deflection of construction above. Use this PTA with lateral shear resistance in conjunction with H & B Gripstay Channels and NS Neoprene Sponge as a complete assembly prior to grouting.

C. Rigid Anchors for intersecting walls: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
   1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M.

2.06 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch, galvanized steel sheet.

C. Anchor Bolts: L-shaped steel bolts complying with ASTM A307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A153/A153M, Class C; of dimensions indicated.

D. Post-installed Anchors: chemical anchors.

1. Load Capacity: 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 E488/E488M, conducted by a qualified independent testing agency.
2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5 unless otherwise indicated.
3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 A1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.07 WEEP VENTS

A. Manufacturer and Type: CavClear Weep Vents as manufactured by Archovations, Inc., 701 Second Street, Hudson, WI 54016, (715) 381-5773 or approved equal.

1. Description: Non-woven mesh with notched bottom.
2. Color: as selected by the Architect from the manufacturer's full color offering to match mortar.
3. Size: 3/8 inch by size to match masonry unit dimensions.

2.08 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Pre-molded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 or PVC, complying with ASTM D2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

D. Single Wythe Cavity Weep units: Provide continuously in base joint of single wythe masonry installations. Units shall be Cavity Weep CV 5010 as manufactured by MTI or Architect approved equivalent.

E. Grout Stop: Provide Hohmann & Barnard, Inc. - HGS Mortar / Grout Screen or approved equal; ASTM D5034, non-corrosive, high strength 1/4 inch mesh polypropylene monofilament screening in widths conforming to CMU units. Cut away as required to allow grout flow at reinforced core locations.

2.09 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 masonry cement mortar unless otherwise indicated.
3. For exterior masonry, use Portland cement-lime masonry cement mortar.
4. For reinforced masonry, use Portland cement-lime masonry cement mortar.

5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

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

C. Mortar for Unit Masonry: Comply with ASTM C270, Property 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 N.
4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
5. For interior non-load-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of Portland cement by weight.
2. Mix to match Architect's sample.
3. Application: Use pigmented mortar for exposed mortar joints with the following units:
   a. Architectural CMUs.
   b. Cast stone trim units.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.
2. Application: Use colored aggregate mortar for exposed mortar joints with the following units:
   a. Architectural CMUs.
   b. Cast stone trim units.

F. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 402/602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi(14 MPa).
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

PART 3 - EXECUTION

3.01 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 work.
2. Verify that foundations are within tolerances specified.

3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

C. 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.

3.03 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch .
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

C. Joints:

1. For 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.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.

4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. 3 mm.

3.04 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: Lay exposed masonry in running bond unless indicated otherwise on the Contract Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar 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. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section {\id\#1000115} - {\t\#1000115}.

3.05 MORTAR BEDDING AND JOINTING

A. 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.

B. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Allow cleaned surfaces to dry before setting.
3. Wet joint surfaces thoroughly before applying mortar.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.06 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:

1. Provide an open space not less than 2 inches wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.07 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. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

C. Control Joint Locations:

1. At major changes in wall height.
2. At changes in wall thickness.
3. At control joints in foundations, roofs and floors.
4. At chases and recesses for piping, columns, fixtures, etc.
5. At one side of wall openings less than 6 feet unless indicated otherwise.
6. At both sides of wall opening exceeding 6 feet.
7. At or near wall intersections.
8. Near return wall angles in L, T, and U shaped structures.
9. All other cases, maximum spacing between joints shall not exceed 30 feet.

3.08 FLASHING

A. General: Install embedded flashing in masonry at 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 lintels, 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.
3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
4. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section {\id\#1000071} - {\t\#1000071} for application indicated.
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.
6. Install metal flashing termination 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 flashing termination.
7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.09 WEEP VENT INSTALLATIONS

A. Place weep vents in head joints at exterior wythe of cavity wall located immediately above ledges and flashing, spaced 24 inches on center, unless otherwise shown. Leave the side of the masonry units forming the vent space unbuttered and clear of mortar. Install with notched side down. Slide vent material into joint as the two masonry units forming the weep vent are placed.

3.10 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 402/602.

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 ACI 530.1/ASCE 6/TMS 402/602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the Building Code of New York State.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

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

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140/C140M for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

G. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

I. Prism Test: For each type of construction provided, according to ASTM C1314 at 28 days.

3.12 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.13 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; 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 hoes 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 them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.14 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 312323 - {\t\#1000089}.
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

1.01 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

B. Brick Support Panel System.

1. Thin Brick Veneer.
2. Mortar.
3. Cleaning.
4. Embedded Flashing.
5. Weep Holes/Vents.
6. Expansion and Control Joints.
7. Fasteners.

1.03 REFERENCES

A. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2022a.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

C. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

D. ASTM C1088 - Standard Specification for Thin Veneer Brick Units Made from Clay or Shale; 2023.

E. ASTM C126 - Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units; 2022.

F. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.

G. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).

H. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2017.

I. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.

J. ASTM D4716/D4716M - Standard Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head; 2022.

K. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

L. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 SUBMITTALS

A. Submit under the provisions of Section 013300 - SUBMITTALS.

B. Manufacturer's Product Data: Provide the manufacturer's preparation, storage, handling, and installation instructions and sample Warranty.

C. Product Data: For each type of Brick indicated. Provide components, sizes,, shapes, colors, textures, and profiles available for selection by the Architect.

D. Shop Drawings: Show installation details of Thin Brick veneer installations including plans, elevations, sections, details, shape requirements, expansion and control joint locations, and attachments to other Work.

E. Samples: For each product, color and texture selected; provide a eight brick sample board representing the color and texture of the brick selected prior to installation for verification.

F. Sample Panel: Construct one 4 foot (121.92 cm) by 4 foot sample panel utilizing final size, color, texture and mortar selections.

1. Obtain architect's acceptance of the sample panel prior to commencing the work of this section.
2. Do not remove the sample panel until the work of this section has been completed and accepted by the Architect.

1.05 QUALITY ASSURANCE

A. Comply with all applicable codes, regulations, and standards. Where provision of applicable codes, regulations, and standards conflict with requirements of this section comply with the most stringent requirements.

B. Obtain materials from one manufacturer to ensure compatibility

C. Manufacturer Qualifications

1. A history of corporate experience with metal supported unit masonry panels.
2. Documented qualifications and capabilities that fully describe the ability to provide the required metal panel system and technical support to the Owner.
3. At least five (5) years thin brick with metal support system experience.

D. Installer Qualifications:

1. Authorized Wall Systems installer or proof of a minimum of five years experience with a related thin masonry support panel system.
2. At least one supervisory journeyman who shall be present at all times during execution of work, who shall be thoroughly familiar with design requirements, type of materials being installed, reference standards and other requirements, and who shall direct all work performed at jobsite in accordance with the manufacturer's specifications.

E. Material Certificates: Prior to delivery site, submit to Architect/Engineer certificates indicating compliance with the applicable specifications for Thin Brick Grades, Types or Classes included in these specifications.

F. Thin Brick Test Reports: Submit test reports substantiating compliance with requirements: Sample and test in accordance with ASTM C67.

1. Testing and reports shall be completed by an independent laboratory.
   a. Test reports for each type of brick shall be submitted to the Architect/Engineer for review.
   b. Thin brick test reports shall indicate:

1) 2-hour cold water absorption
2) 5-hour boil absorption
3) Saturation coefficient
4) Initial rate of absorption
5) Efflorescence

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer’s unopened containers, identified with name, brand, type, and grade. Deliver products of this section on pallets, with individual faces protected and dry.

B. Store units in protected are or under cover on level ground; keep dry. Do not double stack pallets.

C. Store Wall Systems Panels and accessories off the ground, to prevent contamination by mud, dust or other materials likely to cause staining or other defects.

D. Protect materials from contamination, dampness, freezing, or overheating in accordance with manufacturer’s instructions.

E. Store different types of materials separately.

F. Mastic and mortar additive are to be stored above 32° Fahrenheit and below 86° Fahrenheit temperatures & no direct sun light.

G. Store, use and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction and in accordance with current VOC regulations.

H. Cold Weather Requirements:

1. Do not use frozen materials or materials mixed or coated with ice or frost.
2. Do not build on frozen substrates.
3. Remove and replace unit masonry damaged by frost or by freezing conditions.
4. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE
5. Comply with manufacturer's adhesive application and temperature requirements as stated in the manufacturer's installation manual.

I. Hot Weather Requirements:

1. Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE
2. Protect mortar from uneven and excessive evaporation.
   a. The face of the installed thin brick may be dampened with water prior mortar installation to reduce the absorption of moisture from the mortar joint and increase bond
   b. Veneer may be fogged with water to allow the mortar enough time to set. Apply only enough moisture to consistently dampen the wall without allowing water to run down the face.
3. Comply with Wall Systems manufacturer's application and temperature requirements.
4. Protect and shade panels from extended exposure direct sun. Excessive head gain can cause adhesive to flow.

PART 2 - PRODUCTS

2.01 REFERENCE STANDARDS

A. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2022a.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

C. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

D. ASTM C126 - Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units; 2022.

E. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.

F. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).

G. ASTM C1088 - Standard Specification for Thin Veneer Brick Units Made from Clay or Shale; 2024.

H. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.

I. ASTM D4716/D4716M - Standard Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head; 2022.

J. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

K. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

2.02 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Brick
2. Sioux City Brick Co.
3. Glen- Gery Brick
4. Endicott Clay Products.
5. Brick-it

2.03 MATERIALS

A. Thin Brick: ASTM C1088, Grade Exterior, Type TBA (Handmade) or as selected by the Architect from the manufacturer's full type offering, tested in accordance with ASTM C67, as manufactured by Brick-it or approved equal.

1. Size: 1/2 inch (12.7 mm) thick by 2 3/4 inches (19.05 mm) high by 7 5/8 inches (15.88 mm) long (1/2-Engineer Modular)
2. Texture: Smooth or as selected by the Architect to match the existing brick in all respects.
3. Color: as selected by the Architect manufactured by Brick-It.

4. Trim Shapes: All required trim shapes shall be provided as indicated on the drawings or as required by the site conditions.

B. Thin Brick Veneer Support System (Belden Brick/TABS System)

1. Thin Masonry Veneer Support Panel: Metal support panel consisting of 26 gauge 16 mil (0.4064 mm) architectural grade (structural grade 33), stucco embossed, textured steel with angled ties providing structural mechanical support for interior or exterior thin masonry veneer, installed by fastening to concrete, masonry, metal or wood frame construction.
   a. All Metal Panels for thin brick support specified and shown on drawings shall be manufactured by TABS Wall Systems, LLC and as distributed by Belden Tri-State Building Materials; Contact Ken Johnson, (347) 723-9428 or Architect approved equivalent.
   b. Panels: TABS II Wall Panels with support spacing as required by the manufacturer for the brick size as follows:
      1) Modular, Standard, Norman and other 2 1/4 inch (6.35 mm) high units: 2 5/8 inch (15.88 mm) spacing
   c. Tab length: 5/16 inch (7.94 mm).
   d. Exterior Finish: G90 Galvanized with thermal set coating.
   e. Flat Panels: 47 7/8 inch (22.22 mm) by 48 inch (1219.2 mm) masonry support panels for flat wall areas.
   f. Pre-Bent Corner Panels: 8 sq. ft. masonry support panels for external corner applications: 24 inches (609.6 mm) high with 16 inch (406.4 mm) by 32 inch (812.8 mm) unequal leg configuration or a 24 inch (609.6 mm) by 24 inch equal leg configuration.
2. Fasteners for Masonry Support Panels:
   a. Screw fasteners as supplied by the support panel manufacturer: Self-tapping, pan head fasteners with a minimum #8, 0.164 inch (4.17 mm) shank diameter and corrosion resistance provided by G-90 zinc coating, stainless steel or tri-layered ceramic surface coating with a minimum protection of 1000 hrs. when tested according to ASTM B117.
   b. Fastener Length requirements:
      1) Wood stud fasteners: Screws shall penetrate the studs a minimum of 1 inch (25.4 mm).
      2) Metal framing/support member fasteners: Screws shall penetrate not less than member thickness plus three threads 3/16 inch (4.76 mm).
      3) Masonry or Concrete fasteners: Screws shall penetrate the substrate a minimum of 1 inch (25.4 mm).
3. Starter Angle:
   a. Stainless steel conforming to ASTM A240/A240M, Type 304, 0.019 inch (0.48 mm). (24 gauge) pre-bent in 10 feet (304.8 cm) lengths.
4. Flexible Flashing:
   a. Rubberized Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch (1.02 mm).
   b. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, 0.020 inch (0.51 mm) thick, with a
      1) 0.015 inch (0.38 mm) thick coating of rubberized-asphalt adhesive.
5. Adhesives, 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.

a. High-strength mastics must exceed ASTM D3498 and ASTM C557 adhesive manufacturer's specifications for TABS with less than 70 grams of VOC per liter with a shear value between the thin veneer and the panel greater than 100 PSI.
b. Tabs Structural Silicone for natural stone, cast stone or marble.

6. Weather Resistive Barrier:
   a. Provide water resistive barriers shall be Green Guard RainDrop Wrap by Tabs Wall Systems, LLC or equal as designated in Division 07.
7. Drainage Mat/Rainscreen:
   a. Drainage Mat:
      1) Material shall be supplied and be compatible with the Support Wall System manufacturer. Filter fabric laminated to spun and heat welded entangled geomatrix, 0.25 inch (6.35 mm) two-ply polypropylene core mesh with cornrow configuration or Green Guard DC14, MTI Sure Cavity 5mm as approved by manufacturer.
      2) Permits moisture drainage and creates airspace.
      3) Hydraulic Transmissivity, Machine Direction, ASTM D4716/D4716M:
         (a) Flow Rate: 3.70 GPM/ft. width.
         (b) Transmissivity: 7.65E-03 sq yard (03 sq m)/s
      4) Air Transmissivity, ASTM D4716/D4716M, Modified:
         (a) Estimated Flow Rate: 15.8 cu ft./min/ft. width.
         (b) Incremental Transmissivity: 6.97E-04 sq yard (04 sq m)/s.
8. Shims:
   a. 1-1/4 inch (32 mm). wide by 48 in. long, manufactured from G90 hot dip galvanized, 26 gauge (16 mil) architectural grade (structural grade 33) steel with thermal set coating, stucco embossed texture and centered channel.
9. Installation Hardware:
   a. Support Channels: 8 ft. long, manufactured from 26 gauge 18 mil (0.4572 mm) stainless steel with 1/2 in. support leg, 3/4 in. wide by 1/2 in. high clip.
   b. Type / Size of Channel supports shall be provided for high of brick units utilized as required by the manufacturer.
10. Weepholes / Vents:
    a. Thin Tech Air Vent: Impact resistant polypropylene copolymer. Density 2,000 grams/sq. meter. Size: 3/8 inch (9.52 mm) by 1/2 inch (12.7 mm) by 48 inches (1219.2 mm).
11. Continuous Insulation: as indicated on the drawings and supplied by the Support Wall System manufacturer or equal as specified in Section 072100. Supply Assemblies complying with NFPA 285 in locations required by the Building Code and the AHJ.

C. Metal Grid System Panels: Galvanized steel metal components formed to align brick courses and to support and ensure a mechanical bond of each brick in place.

1. Panels shall be chem-dry treated and be a minimum 0.0149-inch 0.01 inch (0.36 mm) thickness with continuous carrying brick ledges (every course of brick) with minimum thickness per ledge:
   a. 0.028 inch (0.71 mm).
2. Panels shall have a continuous interlock every third course, minimum thickness, 0.042 inch 0.04 inch (1.07 mm).
3. Panels shall be able to fold out corners, door and window sections, and have a continuous linear array of holes to receive adhesive and have a continuous array of mortar receptors to lock in mortar mix.

4. Panels shall be designed to carry brick load evenly on entire wall surface without the use of footings, starter angles or special corner sections.
5. Panel Size: 96 inches (2438.4 mm) by height requiredby brick size selected or Custom size as selected by the Architect.
6. Panel Tab spacing: 2 1/4 inches (6.35 mm) or as indicated on the drawings.

D. Mortar:

1. Mortar shall conform to ASTM C270 Standard Specification for Mortar for Unit Masonry under the guidelines provided in BIA Technical Notes #8 Series.
   a. Type S.

E. Control Joints & Expansion Joints

1. Control joints in the panel system are required to coincide with the building control joints where substrates change, within 4 feet (121.92 cm) maximum of outside corners, then every 24 feet maximum. Horizontal control joints should be located at each floor line for wood framing and every other floor line and not to exceed 24 feet for steel stud framing. All Control joints shall comply to local AHJ and building code standards.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect related site conditions; do not commence with work of this section until any adverse conditions are corrected so as not to affect the work of this section.

B. Construction Field Verification Requirements for Wall Systems Support Panels:

1. Walls must be structurally sound and the substrate system designed with a wall deflection not greater than L/360.
2. Maximum stud wall frame spacing: 16" on center
3. Maximum wall girt frame spacing: 30" on center.
4. Minimum 0.043 inch (1.09 mm) metal studs for exterior walls.
5. Substrate shall have no planer irregularities greater than 1/4" in 10'.
6. Verify substrate including, concrete, masonry or framing as well as sheathings and weather barrier are installed in accordance with the approved system manufacturer's specifications.
7. Verify walls are plumb and corners are braced to manufacturer's specifications.
8. Substrate must be flat, within 1/8-inch within any 4-foot square area with no planar irregularities greater than 1/4" per 10 linear feet.

C. Commencement of the work of this section shall be construed as acceptance of the field conditions by the contractor.

3.02 PREPARATION AND COORDINATION

A. Contractor shall test the surfaces for straightness, Plumb and level conditions.

B. Installing Contractor shall notify the Architect where corrections are required by the contractor responsible.

C. Verify that all items to be built into the work of this section are in place and connected as necessary prior to commencing work of this section. Report any items that are not in place to the Architect immediately.

3.03 INSTALLATION

A. Comply with manufacturer's written instructions and specifications for installing Thin Brick Veneer and Support Panel System work.

B. Cut units where required for fitting or for installation of built-in items, using power tools; do not install units having chipped or cracked edges on sight exposed surfaces.

C. Align base courses to follow level floor lines and adjacent brick patterns as directed by the Architect or as indicated on the contract documents.

D. Align faces plumb, level and true with uniform size, color and aligned joint installations.

E. Trim, starter angle and flashing shall be installed prior to panel installation.

F. Size, mix and proportion units for the best appearance and to match existing patterns and coloration as closely as possible. Joints shall be arranged neatly and symmetrically, free from imperfections detracting from the overall appearance of the installation.

G. Lay out panels in advance for accurate spacing of tabs to allow installation of full height masonry units at top and bottom of walls, openings, etc. when possible. Note: Panel sizes will vary depending on spacing.

H. Install panels to ensure a 1/16" – 1/8" gap between the sides of the panels and butt panels vertically, always leaving a gap at movement joints locations equal to the thickness of the joint.

I. Stop panel 1/4" to 3/8" from inside corners, openings and other materials to allow for movement.

J. Apply Thin Brick to backing material in Dry-Set Mortar as recommended by the manufacturer. Solidly bed each unit and provide adequate pressure to fully bed and engage units into bedding material while maintaining alignment of the face surfaces of the units unless indicated otherwise by the contract documents and as warranted by field conditions to match existing surfaces as directed by the Architect.

K. Allow Dry-Set setting mortar to dry as recommended by the manufacturer prior to installing mortar joints in Thin Brick Veneer work.

L. Fill joints completely and tool joints as recommended by the manufacturer. Do not allow mortar to dry on the face of Thin Brick Units. Clean surfaces as recommended by the manufacturer.

M. Architect will observe the appearance of the installed units; installed masonry surfaces shall be free of imperfections detracting from the overall appearance when viewed from a distance of 5 feet normal to the surface(s).

N. Provide Control and Expansion joints as recommended by the manufacturer, as shown on the drawings. Contractor shall honor and install new expansion and control joints directly over the location s of existing joints on existing projects. Seal joints with new sealants to match existing. See Section 079200 - JOINT SEALANTS for materials.

3.04 ADJUSTING AND CLEANING

A. Clean masonry surfaces and paintwork with compatible cleaning products in accordance with the manufacturer's instructions; do not clean with products not specified in the manufacturer's instructions.

B. Remove and replace warped, bowed, displaced, miss-aligned, loose or otherwise damaged brick units as required by and to the satisfaction of the Architect and / or the Owner.

C. Re-point any damaged, missing, cracked, discolored mortar joints to match adjacent mortar jointing the satisfaction of the Architect and / or the Owner.

END OF SECTION

END OF SECTION

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PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes: Portland cement based manufactured stone veneer and trim.
   1. Stone masonry adhered to masonry.
   2. Stone masonry adhered to cold-formed metal framing and sheathing.

1.03 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

A. Product Data: For each variety of stone, stone accessory, and manufactured product.

B. Standard sample board consisting of small-scale pieces of veneer units showing full range of textures and colors.

C. Samples for Initial Selection: For colored mortar and other items involving color selection.

D. Samples for Verification:
   1. For each stone type indicated. Include at least five Samples in each set and show the full range of color and other visual characteristics in completed Work.
   2. For each color of mortar required. Label Samples to indicate types and amounts of pigments used.
   3. Verification Samples: Following initial sample selection submit “laid-up” sample board using the selected stone and mortar materials and showing the full range of colors expected in the finished Work; minimum sample size: 3 by 3 feet (1m by 1 m).

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Regulatory Requirements: Evaluation reports.

C. Veneer manufacturer’s installation instructions.

D. Installation instructions for other materials

E. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, supply sources, and other information as required to identify materials used. Include mix proportions for mortar and source of aggregates.
   1. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents contained in mockups unless Architect approves such deviations in writing.

F. Material Test Reports:
   1. Stone Test Reports: For each stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, other than abrasion

resistance, according to referenced ASTM standards. Base reports on testing done within previous five years.

2. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters familiar with the installation procedures for manufactured veneer products.

B. Manufacturer Qualifications: Licensee of the approved Manufactured Stone manufacturer.

C. Certifications:

1. ICC Evaluation Service - Evaluation Report ESR-1215 (Eldorado Stone Products).
2. NES Evaluation Service- Evaluation Report NER.
3. UL - Classification listing in Building Materials Directory.

D. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for typical exterior wall in sizes approximately 60 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
   a. Include stone coping at top of mockup.
   b. Include a sealant-filled joint at least 16 inches long in mockup.
   c. Include through-wall flashing installed for a 24-inch length in corner of mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit stone masonry above half of flashing).
   d. Include metal studs, sheathing, flashing, and weep holes in exterior masonry-veneer wall mockup.
2. Protect accepted mockups from the elements with weather-resistant membrane.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 PRECONSTRUCTION TESTING

A. Preconstruction Sealant Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for compatibility and adhesion testing according to sealant manufacturer's standard testing methods and Section 079200 - {\t\#1000071}. Samples of materials that will contact or affect joint sealants.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials as recommended by the manufacturer.

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

C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, in a dry location, or in covered weatherproof dispensing silos.

1.09 FIELD CONDITIONS

A. Environmental Requirements: When air temperature is 40 degrees F (4.5 degrees C) or below, consult local building code and procedures specified herein for Cold-Weather Construction requirements.

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

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

C. Stain Prevention: Immediately remove mortar and soil to prevent them from staining stone masonry face.

1. Protect base of walls from rain-splashed mud and mortar splatter using coverings spread on the ground and over the 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 end of each day to prevent rain from splashing mortar and dirt on completed stone 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 stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in TMS 402/602 /ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above 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 402/602/ASCE 6/TMS 602.

1.10 COORDINATION

A. Advise installers of other work about specific requirements for placement of flashing and similar items to be built into stone masonry.

1.11 MAINTENANCE MATERIALS

A. Provide 5 percent of the coverage area for units in shapes, colors and sizes.

1.12 WARRANTY

A. Special Warranty: Manufacturer’s standard warranty coverage against defects in materials when installed in accordance with manufacturer’s installation instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Boral Cultured Stone, Tel. (800)255-1727, www.culturedstone.com
   2. ProVia, 1550 Country Road 140, Sugarcreek OH 44681, Tel. 800.669.4711, www.provia.com
   3. or Architect approved equivalent.

B. Source Limitations for Manufactured Stone: Obtain each variety of stone, from single source with resources to provide materials of consistent quality in appearance and physical properties.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

2.02 PRODUCTS

A. Veneer Unit properties: Precast veneer units consisting of portland cement, lightweight aggregates, and mineral oxide pigments.
   1. Compressive Strength: ASTM C192/C192M and ASTM C39/C39M, 5 sample average: greater than 1,800 psi (12.4MPa).
   2. Shear Bond: ASTM C482: 50 psi (345kPa).
   3. Water Absorption: UBC Standard 15-5: Less than 22 percent.
   4. Freeze-Thaw Test: ASTM C67: Less than 3 percent weight loss and no disintegration and 2.
   5. Thermal Resistance: ASTM C177: 0.473 at 1.387 inches thick.

B. Product: Veneer stone shall be Patern and Color palette as selected by the Architect form the manufacturer's full range of patterns and colors..

C. Reinforcing: ASTM C847, 3.4lb (1.8 kg/m2) galvanized 3/8” rib lath complying with code agency requirements for the type of substrate over which stone veneer is installed.

D. Mortar:
   1. Cement: Any cement complying with ASTM C270.
   2. Lime: ASTM C207.
   3. Sand: ASTM C144, natural or manufactured sand.
   4. Color Pigment: ASTM C979/C979M, mineral oxide pigments.
   5. Water: Potable.
   6. Pre-Packaged Latex-Portland Cement Mortar: ANSI A118.4.

E. Bonding Agent: Exterior integral bonding agent meeting ASTM C932, ASTM C1059/C1059M Type II.

F. Sealer: Water based silane or siloxane masonry sealer, clear semi-gloss.

2.03 MORTAR MIXES

A. Standard Installation (Grouted Joints):
   1. Mix mortar in accordance with ASTM C270, Type N or S.

a. Add color pigment in grout joint mortar in accordance with pigment manufacturer’s instructions.

B. Jointless/Dry-Stacked Installation:

1. Mix mortar in accordance with approved Manufactured Stone Company requirements for mortar preparation instructions.
   a. Add color pigment in accordance with pigment manufacturer’s instructions.

2.04 MORTAR MATERIALS

A. Regional Materials: Aggregate for mortar and grout, cement, and lime shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; natural color or white cement may be used as required to produce mortar color indicated.

1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.

C. Hydrated Lime: ASTM C207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Essroc, Italcementi Group; Saylor's Plus.
   b. Lafarge North America Inc.; Eaglebond.
   c. Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

E. Colored Portland Cement-Lime Mix: Packaged blend of Portland cement, hydrated lime, and mortar pigments. Mix shall produce color indicated or, if not indicated, as selected from manufacturer's full range of colors. Pigments shall not exceed 10 percent of portland cement by weight.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Lafarge North America Inc.; Eaglebond.
   b. Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
   c. Architect approved equivalent.

F. Colored Masonry Cement Mix: Packaged blend of masonry cement and mortar pigments. Mix shall produce color indicated or, if not indicated, as selected from manufacturer's full range of colors. Pigments shall not exceed 5 percent of masonry cement by weight.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Essroc, Italcementi Group; Flamingo-Brixment.
   b. Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
   c. Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
   d. Architect approved equivalent.

G. Aggregate: ASTM C144:

1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.
2. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
   a. Match Architect's sample.

H. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed Portland cement mortar bed, and not containing a retarder.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Laticrete International, Inc.
      b. MAPEI Corporation.
      c. ProSpec; Bonsal American; a division of Oldcastle Architectural Products Group.
      d. Architect approved equivalent.

I. Water: Potable.

2.05 STONE TRIM ANCHORS

A. Stone Trim Anchors: Units fabricated with tabs or dowels designed to engage kerfs or holes in stone trim units and holes for fasteners or post-installed anchor bolts for fastening to substrates or framing as indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Heckmann Building Products Inc.
      b. Hohmann & Barnard, Inc.
      c. Architect approved equivalent.

B. Materials: Fabricate anchors from stainless steel, ASTM A240/A240M or ASTM A666/A666M, Type 304. Fabricate dowels from stainless steel, ASTM A276/A276M, Type 304.

C. Fasteners for Stone Trim Anchors: Annealed stainless-steel bolts, nuts, and washers; ASTM F593 for bolts and ASTM F594 for nuts, Alloy Group 1.

D. Post-installed Anchor Bolts for Fastening Stone Trim Anchors: Chemical anchors made from stainless-steel components complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 for bolts and nuts; ASTM A666/A666M or ASTM A276/A276M, Type 304 or Type 316, for anchors.

2.06 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: For flashing unexposed to the exterior, use one of the following unless otherwise indicated:
   1. Copper-Laminated Flashing: 7-oz./sq. ft. copper sheet bonded with asphalt between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) Dayton Superior Corporation, Dur-O-Wal Division ; Copper Fabric Thru-Wall Flashing.
         2) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
         3) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
         4) York Manufacturing, Inc.; York Copper Fabric Flashing.
         5) Architect approved equivalent.

B. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 - {\t\#1000105}.

2.07 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Cementitious Dampproofing: Cementitious formulation recommended by ILI and nonstaining to stone, compatible with joint sealants, and noncorrosive to veneer anchors and attachments.

C. Weep Products: Use one of the following unless otherwise indicated:

1. Mesh Weep Holes: Free-draining mesh; made from polyethylene strands, full width of head joint and 2 inches high by thickness of stone masonry; in color selected from manufacturer's standard.
    a. Products: Subject to compliance with requirements, provide one of the following:
        1) Mortar Net USA, Ltd.; Mortar Net Weep Vents.
        2) Architect approved equivalent.

D. Expanded Metal Lath: 3.4 lb/sq. yd., self-furring, diamond-mesh lath complying with ASTM C847. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G60.

E. Lath Attachment Devices: Material and type required by ASTM C1063 for installations indicated.

F. Drainage Plane Units: High impact polystyrene sheets, 0.024 inch thick, formed with corrugations and a spunbond polypropylene fabric, charcoal color, attached to one side with a 4 inch overlapping skirt on one edge; 3/16 inch squared channel depth Sure Cavity TM, SCMM 2516 as manufactured by MTI- Masonry Technology Incorporated, Tel. 800-879-3348; email: info @mtidry.com.

2.08 FABRICATION

A. Finish exposed stone faces and edges to comply with requirements indicated for finish and to match approved samples and mockups.

1. Finish for Sills: Smooth.
2. Finish for Copings: Smooth.
    a. Finish exposed ends of copings same as front and back faces.

2.09 MORTAR 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.
2. Use Portland cement-lime mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
4. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar

reaches required consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.

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

C. Mortar for Stone Masonry: Comply with ASTM C270, Property Specification.

1. Mortar for Setting Stone: Type N.
2. Mortar for Pointing Stone: Type N.

D. Latex-Modified Portland Cement Setting Mortar: Proportion and mix portland cement, aggregate, and latex additive to comply with latex-additive manufacturer's written instructions.

E. Cement-Paste Bond Coat: Mix either neat cement and water or cement, sand, and water to a consistency similar to that of thick cream.

1. For latex-modified, portland cement, setting-bed mortar, substitute latex admixture for part or all of water, according to latex-additive manufacturer's written instructions.

F. Mortar for Scratch Coat over Metal Lath: 1 part portland cement, 1/2 part lime, 5 parts loose damp sand, and enough water to produce a workable consistency.

G. Pigmented Mortar: Use colored cement product.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.

H. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary.

1. Mix to match Architect's sample.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry.

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

3.02 PREPARATION

A. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives and only as approved by the manufacturer.

3.03 SETTING OF STONE MASONRY, GENERAL

A. Perform necessary field cutting and trimming as stone is set.

1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.

B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

C. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

D. Set stone to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

E. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 1/4 inch at narrowest points or more than 5/8 inch at widest points.

F. Provide sealant joints of widths and at locations indicated.
   1. Keep sealant joints free of mortar and other rigid materials.
   2. Sealing joints is specified in Section 079200 - {\t\#1000071}.

G. Install metal expansion strips in sealant joints at locations indicated. Build flanges of expansion strips into masonry by embedding in mortar between stone masonry and backup wythe. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.

H. Install embedded flashing and weep holes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
   1. At stud-framed walls, extend flashing through stone masonry, up sheathing face at least 16 inches, and behind weather barrier.
   2. At lintels and shelf angles, extend flashing full length of angles but not less than 6 inches into masonry at each end.
   3. At sills, extend flashing not less than 4 inches at ends.
   4. At ends of head and sill flashing, turn up not less than 2 inches to form end dams.
   5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 - {\t\#1000071} for application indicated.
   6. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 - {\t\#1000071} for application indicated.
   7. Extend sheet metal flashing 1/2 inch beyond masonry face at exterior, and turn flashing down to form a drip.

I. Place weep holes in joints where moisture may accumulate, including above shelf angles and at flashing.
   1. Use mesh weep holes to form weep holes.

3.04 CONSTRUCTION TOLERANCES

A. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet or more.

3.05 INSTALLATION OF ADHERED STONE MASONRY VENEER

A. Install and clean stone in accordance with manufacturer's installation instructions for Jointless / Dry-Stacked installation.

B. Apply sealer in accordance with sealer manufacturer's installation instructions.

C. Install flashing over sheathing and behind weather-resistant sheathing paper by fastening through sheathing into framing.

D. Install lath over weather-resistant sheathing paper by fastening through sheathing into framing to comply with ASTM C847.

E. Install scratch coat over metal lath 3/8 inch thick to comply with ASTM C926.

F. Coat backs of stone units and face of scratch coat with cement-paste bond coat, then butter both surfaces with setting mortar. Use sufficient setting mortar so a slight excess will be forced out the edges of stone units as they are set. Tap units into place, completely filling space between units and scratch coat.

3.06 ADJUSTING AND CLEANING

A. Remove and replace stone masonry of the following description:
   1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
   2. Defective joints.
   3. Stone masonry not matching approved samples and mockups.
   4. Stone masonry not complying with other requirements indicated.

B. Replace in a manner which results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.

D. Remove protective coverings from adjacent work.

E. Cleaning Veneer Units:
   1. Wash with soft bristle brush and water/granulated detergent solution.
   2. Rinse immediately with clean water.

F. Removing Efflorescence:
   1. Allow veneer to dry thoroughly.
   2. Scrub with soft bristle brush and clean water.
   3. Rinse immediately with clean water; allow to dry
   4. If efflorescence is still visible, repeat above procedure using a solution of 1 part household vinegar and 5 parts water.
   5. Rinse immediately with clean water.

3.07 EXCESS MATERIALS AND WASTE

A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Structural steel.
   2. Grout.
   3. Base Plates.

B. Related Requirements:
   1. Division 01 - "Quality Requirements" for independent testing agency procedures and administrative requirements.
   2. Section 053100 - "Metal Decking" for field installation of shear connectors through deck.
   3. Section 055000 - "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame not defined as structural steel.
   4. Section 055100 "Metal Stairs".
   5. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" and for surface-preparation and priming requirements.

1.03 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:
   1. Shapes included in ASTM A6/A6M with flanges thicker than 1-1/2 inches (38 mm).
   2. Welded built-up members with plates thicker than 2 inches (50 mm).
   3. Column base plates thicker than 2 inches (50 mm).

1.04 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 anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.05 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Shop drawings and required calculations shall bear the seal and signature of a registered Professional Engineer licensed in the state in which the project is located. Structural steel shop drawings will not be reviewed without said seal and signature.
   a. A full set of engineered calculations for all beam to column moment connections shall be submitted to the engineer of record for approval. The steel fabricator drawings shall not be reviewed without said engineering calculations affixed with a seal and signature of a professional engineer licensed in the state in which the project is located.
2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
3. Include embedment Drawings.
4. Indicate profiles, sizes, spacing and locations of structural members, openings, attachments, fasteners, connections, cambers, holes and other pertinent data. Include locations of structural members, openings, attachments and loads.
5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
7. For structural steel connections indicated to comply with design loads, include structural design data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer / fabricator.

B. Welding certificates: Submit certificates certifying that welders employed in the work have met AWS qualifications within in the previous 12 months.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties. Indicate structural strength, destructive and non-destructive test analysis.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Non-shrink grout.

1.08 QUALITY ASSURANCE

A. Fabricator shall have a minimum of five (5) years documented experience with performing the work of this section.

B. Installer Qualifications: A qualified installer specializing in performing the work of this section with a minimum of three (3) years of documented experience.

C. Delegated Connection Designer: Connections not fully detailed on the contract drawings shall be designed under the direct supervision of a professional structural engineer experienced in the design of this work and licensed in the state in which the work is located. The shop drawings shall bear the seal and signature of same professional engineer.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
2. Welders who are welding structural members fabricated in the shop or in the field, in the five boroughs must have a NYCDOB issued welder licence.

E. Comply with applicable provisions of the following specifications and documents:

1. AISC Code of Standard Practice for Steel Buildings and Bridges - AISC 303.
2. AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings - AISC 360.
3. RCSC's "Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts."

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle products to/at the site under the supervision of Division 01 of this Project Manual.

B. Schedule deliveries of materials to the site at intervals which will ensure uninterrupted progress of the work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

D. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and experience. who bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F1852 fasteners and for retesting fasteners after lubrication.

1.10 COORDINATION

A. Coordinate the work under Division 01 specification of this Project Manual.

B. Coordinate the selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturer's recommendations to ensure that shop primers and topcoats are compatible with one another.

C. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions and directions for installation.

D. Coordinate the work of this section with utility installations and all other adjacent work.

E. Coordinate the work of this section such that general progress of the Work in not interrupted.

1.11 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on the plans and approved shop drawings.

B. The contractor is responsible for the proper location and elevations of the work.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated where beam end reactions are not shown on drawings. Connection designer shall design shear connections to resist the reaction resulting from the maximum allowable uniform load of the beam found in the AISC Specification being applied along its full length.

1. Select and complete connections using AISC 360.
2. Use Load and Resistance Factor Design; data are given at factored-load level.

B. Moment Connections: Type FR, fully restrained. Provide design and details of moment connections to resist forces shown on the contract drawings.

C. Construction: Moment frame and Braced frame.

2.02 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. W-Shapes: ASTM A 992/A 992M.

C. Channels, Angles, M-Shapes: ASTM A 36/A 36M.

D. Plate and Bar: ASTM A 36/A 36M.

E. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C, seamless structural tubing.

F. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.
   1. Weight Class: as indicated on the contract documents.
   2. Finish: Black except where indicated to be galvanized.

G. Welding Electrodes: Comply with AWS requirements.

2.03 BOLTS, CONNECTORS, AND ANCHORS

A. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
   1. Finish: Hot-dip zinc coating.
   2. Direct-Tension Indicators: ASTM F959/F959M, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating finish.

B. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; all with plain finish.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490 (A 490M), Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH, (ASTM A563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers with plain finish.
   1. Direct-Tension Indicators: ASTM F959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.

D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
   1. Finish: Plain.

E. Shear Connectors: ASTM A108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

F. Anchor Bolts: ASTM F1554, 36 and 55 ksi yield strength for moment resisting anchor rods.
   1. Nuts: ASTM A563 heavy-hex carbon steel.
   2. Plate Washers: ASTM A36/A36M carbon steel.
   3. Washers: ASTM F436/F436M, Type 1, hardened carbon steel.
   4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

G. Threaded Rods: ASTM A 36/A 36M.
   1. Nuts: ASTM A563 ASTM A563M heavy-hex carbon steel.
   2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
   3. Finish: Plain.

H. Clevises: Made from cold-finished carbon steel bars, ASTM A108, Grade 1035.

I. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A108, Grade 1030.

J. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A108, Grade 1018.

2.04 PRIMER

A. Primer: Comply with Division 09

B. Primer: SSPC-Paint 15, Type I, red oxide.

C. Ensure primer is compatible with required topcoat.

D. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.05 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

B. Grout shall consist of a premixed compound with cement, water reducing and plasticizing additives capable of developing a minimum compressive strength of 7000 psi at 28 days.

2.06 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A6/A6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. All wide flange structural steel members shall be fabricated in accordance with ASTM A992/A992M. All miscellaneous steel members including channels, angles, S, HP, and M shapes shall be fabricated in accordance with ASTM A36/A36M.
6. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
7. All shop connections shall be welded or high strength bolted.
8. Bearing surfaces shall be planed true to provide full bearing over the entire surface.
9. Continuously seal joined members by intermittent welds and plastic filler. Grind welds smooth where exposed or where interference with other building materials is encountered,
10. Splicing is not permitted unless indicated on the Contract Documents or accepted on the final approved Shop Drawings.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces. Mechanically thermal cut bolt holes shall not be permitted unless prior approval by the Architect is obtained in writing.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning." or SSPC-SP 3, "Power Tool Cleaning." unless a more stringent cleaning method is required for selected primers and / or other coatings.

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

G. Shop prime non-exposed steel members after fabrication in accordance with SSPC- PA. Do not prime surfaces that will be fireproofed, field welded or are in contact with concrete or high strength bolts.

H. Paint exposed structural steel members in accordance with the applicable Division 09 Specification section.

I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning unless approved by the Architect in writing.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.07 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM F3125/F3125M, Grade A325 or Grade A490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened unless otherwise shown on the contract documents or required by the connection designer.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.08 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5

mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.09 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M.
   1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
   2. Galvanize lintels, shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
   1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
   1. Inspection and Tests will not relieve the contractor of responsibility for providing materials, fabrication and erection procedures in compliance with the specified requirements. The contractor shall verify that all materials meet or exceed the requirements specified in these specifications, Contract drawings and related references. Materials not in compliance with the specified requirements will be rejected and required to be removed from the site.
C. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM F3125/F3125M , Grade A325 or Grade A490 Bolts."
D. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M type required for materials being welded and the following inspection procedures, at testing agency's option:
   1. Liquid Penetrant Inspection: ASTM E165/E165M.
   2. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
   3. Ultrasonic Inspection: ASTM E164.
   4. Radiographic Inspection: ASTM E94.
E. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
   1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other drawings for compliance with requirements.
   1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other drawings showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation will indicate that the erector accepts the conditions which exist.

3.02 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
   1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.
   2. Clean bearing surfaces and other surfaces which will be in permanent contact with the work.

3.03 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Proceed with the installation only after unsatisfactory conditions have been corrected. Commencement of installation will indicate that the erector accepts the conditions which exist.

C. Allow for erection loads and for sufficient temporary bracing to maintain structure safe, plumb and in true alignment until completion of erection and installation of permanent bracing.

D. Coordinate placement of anchors in concrete or masonry construction for securing bearing plates.

E. Erect all components in accordance with the approved shop drawings.

F. Field weld components and shear studs as indicated on approved shop drawings and in accordance with AWS D1.1/D1.1M.

G. Do not field cut or alter structural members without written approval of the Engineer.

H. Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of baseplate.
   3. Snug-tighten Pretension anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
5. Coordinate placement of anchors in concrete or masonry construction for securing base plates.

I. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

J. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

K. Splice members only where indicated.

L. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

M. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

N. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

O. Erect all components in accordance with approved shop drawings. After erection, prime welds, abrasions and surfaces not shop primed or galvanized as required, except surfaces to be in contact with concrete.

P. Field weld components and shear studs as indicated on the approved shop drawings and in accordance with AWS D1.1/D1.1M.

3.04 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM F3125/F3125M, Grade A325 or Grade A490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened Pretensioned unless specifically identified as pretensioned or slip-critical on the. contract documents or calculations by the Delegated Connection designer.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.
4. Connections and abrasions shall be cleaned, prepared and finished in the same manner and with the same materials used in shop finishing.

3.05 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Verify structural-steel materials and inspect steel frame joint details.
   2. Verify weld materials and inspect welds.
   3. Verify connection materials and inspect high-strength bolted connections.
B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
C. Bolted Connections: Inspect and test high strength bolted connections according to RCSC's "Specification for Structural Joints Using ASTM F3125/F3125M, Grade A325 or Grade A490 Bolts."
D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
   1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E165/E165M.
      b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
      c. Ultrasonic Inspection: ASTM E164.
      d. Radiographic Inspection: ASTM E94.
E. Post Installed Mechanical Anchors, Adhesive Anchors and Screw Anchors: Comply with 2025 Building Code New York State Table 1705.3.
   1. The special inspection shall include the verification of compliance with approved construction documents and standards established by the Commissioner pursuant to Section 28-113.2.2 of the Administrative Code.
F. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
   1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.
G. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.06 TOLERANCES

A. All members shall be installed within AISC tolerances and as follows:
   1. Maximum variation from plumb: 1/4" (6mm) per story, non-cumulative.
   2. Maximum offset from true alignment: 1/4" (6mm).

3.07 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A780/A780M.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

D. Touchup Priming: Cleaning and touchup priming as specified in Division 9 "High-Performance Coatings" or compatible primer established at the fabricators shop to be compatible with the final finish.

3.08 ADJUSTING

A. All misfits due to errors in location, fabrication, inaccuracies in the setting of anchor bolts or other items of attachment or support shall be immediately reported to the Engineer and corrected in a manner subject to the approval of the Engineer.

B. Submit method of correction to the Architect under Division 01 Specification provisions.

C. Proceed with corrective work only after receiving written approval from the Architect.

D. All corrections shall be made at no additional cost to the Owner.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Open web steel joists with bridging.
   2. Loose bearing plates and anchors for site placement.
   3. Framed openings greater than 18 inches.
   4. Joist accessories.

1.03 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support non-uniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

C. Fabricator: Company specializing in performing the work of this section with a minimum of five (5) of documented experience.

D. Erector: Company specializing in performing the work of this section with a minimum of three (3) of documented experience.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, structural steel paint, high strength bolts including nuts and washers.

B. Shop Drawings:
   1. Include layout, designation, number, type, location, and spacing of joists.
   2. Include joining and anchorage details, bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
   3. Indicate locations and details of bearing plates to be embedded in other construction.
   4. Indicate welded connections with AWS D2.0 welding symbols. Indicate weld lengths.
   5. Design of connections not detailed on the drawings shall be accomplished under the direct supervision of a professional structural engineer experienced in the design of this work and licensed in the state in which the project is located.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and professional engineer.

B. Welding certificates.
   1. Submit certificates certifying that welders employed on the project have met AWS Qualification within the last 12 months.

C. Manufacturer certificates: Certify that products meet or exceed specified requirements..

D. Mill Certificates: For each type of bolt.

E. Qualification Data: For Manufacturer. Company specializing in performing the work of this section with minimum of 5 years documented experience.

F. Erector: Company specializing in performing the work of this section with minimum of three (3) documented experience.

G. Design connections not detailed on the drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the project is located.

H. Field quality -test and inspection reports.

I. Research / Evaluation Reports: For Joists.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications.

1. Maintain one copy of document on site.
2. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications and under the provisions of Section 016500 - PRODUCT DELIVERY, STORAGE AND HANDLING.

B. Schedule deliveries of materials to the site at intervals which will ensure uninterrupted progress of the work.

C. Do not store or handle joists in a manner which will damage or distort the joists or supporting structures.

D. Do not store joists directly on the ground.

E. Store materials in a manner which will permit easy access for inspection and identification.

F. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.08 SEQUENCING

A. Deliver steel bearing plates to be built into cast-in-place concrete and masonry construction.

1.09 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on the drawings and approved shop drawings and as required by the manufacturer.

B. The contractor is responsible for the proper locations and elevations of all work involved in this section.

1.10 COORDINATION

A. Coordinate the work under provisions of Division 01 specification of the contract documents.

B. Coordinate the work of this section with utilities and mechanical work installation and all other adjacent work.

C. Coordinate the placement of anchor bolts with the installation of masonry work.

D. Coordinate the work of this section such that the progress of the construction work is not interrupted.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.

1. Use ASD; data are given at service-load level.
2. Design special joists to withstand design loads with live-load deflections no greater than the following:
    a. Floor Joists: Vertical deflection of 1/360 of the span.

2.02 K, LH-SERIES, AND JOIST GIRDERS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series", “Standard Specifications for Longspan Steel Joists, LH-series and Deep Longspan Steel Joists, DLH-Series” in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

1. Joist Type: LH series steel joists. Size as indicated on the drawings.
2. Acceptable manufacturers:
    a. Vulcraft Nucor Group.
    b. Canam.
    c. Architect/Engineer approved equivalent.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members

C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds and methods used in correcting the welding work.

D. Welding Materials: AWS D1.1/D1.1M; type required for the materials being welded.

E. Provide holes in chord members for connecting and securing other construction to joists.

F. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications" - ASTM A36/A36M.

G. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications" - ASTM A36/A36M.

H. Camber joists according to SJI Standard Specifications.

I. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

J. Weld threaded lugs to chords for attachment of wood nailers

K. Frame special sized openings in joist chord framing member configurations as detailed.

L. Design and fabricate top and/or bottom chord bridging for net uplift on steel roof joists as per design loads provided on the contract drawings and in accordance with the New York State Building Code and SJI Standard Specifications.

M. Bolts, Nuts and Washers: ASTM A325; galvanized to ASTM A153/A153M for galvanized members; thread excluded from the shear pane; beveled washers for connection to members with flange slope greater than 1:20.

2.03 PRIMERS

A. Primer: SSPC-Paint 15, Type 1, red oxide or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.04 FINISHES

A. Prepare joist surfaces in accordance with SSPC-SP 2 or SSPC-SP 3.

B. Shop prime joists after fabrication in accordance with SSPC-PA 1. Do not prime surfaces that will be fireproofed, field welded or in contact with concrete.

C. Field welds, connections, and abrasions shall be cleaned, prepared and finished in the same manner and with the same materials used for shop finishing.

2.05 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Fabricate steel bearing plates from ASTM A36/A36M steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint.

C. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface unless otherwise indicated.

1. Finish: Plain; uncoated.

D. High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy hex steel structural bolts galvanized to ASTM A153/A153M; threads excluded from the shear plane; beveled washers for connection to members with flange slope greater than 1:20; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

E. Welding Electrodes: Comply with AWS standards.

F. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20, ASTM A780/A780M.

G. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.06 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories. Shop prime joists after fabrication in accordance with SSPC-PA 1. Do not prime surfaces scheduled to be fireproofed, field welded or to be in contact with concrete.

C. Field weld, connections and abrasions shall be cleaned, repaired and finished in the same manner and with the same materials used for shop finishing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify existing conditions under the provisions of Section 013100 - PROJECT MANAGEMENT AND COORDINATION.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Clean joist bearing surfaces of any debris or foreign matter.
3. Verify bearing surface is smooth and flat.
4. Coordinate placement of anchors in concrete or masonry construction for securing bearing plates.
5. Field weld components and shear studs as indicated on approved shop drawings in accordance with AWS D1.1/D1.1M.
6. Space, adjust, and align joists accurately in location before permanently fastening.
7. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction and remain plumb and in true alignment until completion of erection and installation of permanent bridging and bracing.
8. Delay rigidly connecting bottom- chord extensions to columns or supports until dead loads have been applied.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Frame openings greater than 18 inches with supplementary framing.

E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with Research Council on Structural Connection's "Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts" for high-strength structural bolt installation and tightening requirements.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

G. Do not permit erection of decking until joists are braced, bridged and secured.

H. Do not field cut or alter structural members without the approval of the joist fabricator and the Engineer.

I. After erection; prime welds, abrasions and surfaces not shop primed, except surfaces to be in contact with concrete.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to inspect field welds, bolted connections and to perform field tests and inspections and prepare test and inspection reports.

B. Testing and analysis of components shall be performed under the provisions of Section 014500 - QUALITY CONTROL.

C. Inspection and tests will not relieve the Contractor of responsibility for providing materials and fabrication and erection procedures in compliance with specified requirements. The Contractor is to verify that all materials meet the requirements specified in these specifications.

D. Materials not in compliance with the specified requirements will be rejected.

E. Visually inspect field welds according to AWS D1.1/D1.1M.

1. In addition to visual inspection, test field welds according to AWS D1.1/D1.1M and the following procedures, as applicable:
    a. Liquid Penetrant Inspection: ASTM E165/E165M.
    b. Magnetic Particle Inspection: ASTM E709.
    c. Ultrasonic Testing: ASTM E164.
    d. Radiographic Testing: ASTM E94.

F. Visually inspect bolted connections.

G. High-strength, field bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts."

H. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

I. Perform additional testing to determine compliance of corrected Work with specified requirements.

J. Additional testing will be performed to determine compliance of corrected Work with the specified requirements.

3.04 TOLERANCES

A. All joists shall be installed within SJI tolerances and the following:
   1. Maximum variation from plumb: 1/4 inch.
   2. Maximum offset from true alignment: 1/4 inch.

3.05 ADJUSTING

A. All misfits due to errors in location or fabrication or inaccuracies in the setting of anchor bolts or other items of attachment or support shall be immediately reported to the Architect and corrected in such a manner subject to the approval by the Architect.

B. Submit method of correction to the Architect for approval under the provisions of Section 014500 - QUALITY CONTROL.

C. Proceed with corrective work only after receiving written approval from the Architect.

D. All corrections shall be made at no additional cost to the Owner.

3.06 PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime welds, rust spots, and abraded surfaces of joists, bearing plates, and accessories which are not shop primed, except surfaces to be in contact with concrete.
   1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2, or power-tool cleaning according to SSPC-SP 3.
   2. Apply a compatible primer of same type as primer used on adjacent surfaces.

C. Protect finished work under the provisions of Section 015000 - TEMPORARY FACILITIES AND CONTROLS.

D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that joists and accessories are without damage or deterioration at time of final acceptance by the Owner.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Roof deck and accessories.
   2. Formed steel cant strips.
   3. Bearing plates and angles
   4. Framing for openings up to and including 18 inches.
   5. Closure panels for cell voids.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated provide deck profile characteristics and dimension, structural properties and finish.
   1. Include a statement indicating costs for each product having recycled content.

B. Shop Drawings:
   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction. Indicate temporary shoring of decking where required. Indicate welded connections using standard AWS A2.0 welding symbols and indicate net weld lengths.

1.04 INFORMATIONAL SUBMITTALS

A. Submit under the provisions of Section 013300 - {\t\#1000041}.

B. Welding certificates.

C. Product Certificates: For each type of steel deck by product manufacturer.

D. Manufacturer's instructions: indicate special installation sequence and special instructions required for proper installation.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
   1. Power-actuated mechanical fasteners.

F. Research/Evaluation Reports: For steel deck.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Installer: Company specializing in performing the work of this section with a minimum of three (3) years of documented experience.

C. Design deck layout, spans, fastening and joints under the supervision of a Professional Structural Engineer experienced in the design of this work and licensed in the State in which the project is located.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

E. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

F. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

G. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

H. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

1.06 PERFORMANCE REQUIREMENTS

A. Metal decking design shall be in accordance with SDI Design Manual for Composite Decks, Form Decks, and Roof Decks. Substitutions shall be designed to meet or exceed published section properties of the specified materials. Section properties shall be computed in accordance with American Iron and Steel Institute Specification for the Design of Cold Formed Steel Structural Members.

B. Lateral deflection of diaphragm shall not exceed 1/500 of the story height. Maximum vertical deflection shall not exceed L/240 of the span length.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Cut plastic wrap to encourage ventilation.

C. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

D. Do not handle products in a manner which will distort or damage materials.

E. Do not store decking directly on the ground.

F. Store materials in a manner which will permit ease of access for inspection and identification.

G. Schedule delivery of the materials to the site at intervals which will ensure uninterrupted progress of the work.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

1.08 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on the contract drawings and approved shop drawings as required by the manufacturer.

B. The contractor is responsible for the proper locations and elevations of the work of this section.

1.09 COORDINATION

A. Coordinate the work under provisions of Section 013100 - PROJECT MANAGEMENT AND COORDINATION.

B. Coordinate the work of this section with utility installations and all other adjacent work.

C. Coordinate the work such that the general progress of the work is not interrupted.

1.10 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Metal decking design shall be in accordance with SDI Design Manual for Composite Decks, Form Decks, and Roof Decks. Substitutions shall be designed to meet or exceed published section properties of the specified materials. Section properties shall be computed in accordance with the American Iron and Steel Institute Specification for the Design of Cold Formed Steel Structural Members

C. Lateral deflection of diaphragm shall not exceed 1/500th of the story height. Maximum vertical deflection shall not exceed L/240th of the span length.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

E. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

PART 2 - PRODUCTS

2.01 METAL ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Nucor Corp.; Vulcraft Division.
2. Canam.
3. New Millennium Building Systems.
4. Substitutions shall be permitted only after receiving approval from the Architect/Engineer.

B. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Minimum 33 Ksi yield strength, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

a. Color: Manufacturer's standard.
2. Deck Profile: Type B or as indicated on the drawings.
3. Design Uncoated-Steel Thickness: 20 gauge unless otherwise indicated.
4. Span Condition: Simple span.
5. Side Laps: Overlapped.

2.02 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Welded Materials: AWS D1.1/D1.1M.

C. Primer: Flexible, Rust inhibitive.

D. Touch-up Primer: Red Oxide Type.

E. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

F. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

G. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber. one inch thick profile to fit tight to decking in compression.

H. Shear Connectors: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter. Locate as indicated on the contract drawings.

I. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material, gauge and finish as deck; of profile indicated or required for application.

J. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

K. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

L. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

M. Recessed Sump Pans: Single-piece steel sheet, 14 gauge or 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch (76-mm) wide flanges and sloped recessed side pans of 1-1/2inch (38-mm) minimum depth below deck surface. For drains, cut holes in the field.

N. Galvanizing Repair Paint: ASTM A780/A780M.

O. Bearing Plates and Angles: ASTM A36/A36M steel, unfinished.

P. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

Q. Closure Panels: Neoprene Blend-FR as manufactured by Carrington Specialty Products, Inc., or approved equal.

1. Fire-rated Neoprene-blend formed to match profile of deck at each location.
2. Install compatible backer rod and sealant to seal all edge conditions airtight.

3. Physical Characteristics:
    a. Nominal Density: 5 to 7 pcf.
    b. Tensile Strength: 50 psi.
    c. Elongation: 150% to break.
    d. Compression Set: 50% of original thickness.
    e. Compression Strength: 2 to 5 psi (at 25% deflection).
    f. Working Temperature: -40 to 160 degrees F.
    g. Water Absorption by Weight: 5% maximum.
    h. Flammability: HF-1 as per UL 94.

2.03 SOURCE QUALITY CONTROL

A. Testing and analysis of components will be performed under provisions of Section 014500 - QUALITY CONTROL.

B. Inspection and tests will not relieve the Contractor of responsibility for providing materials and fabrication and erection procedures in compliance with specified requirements. The Contractor is to verify that all materials meet or exceed the requirements specified in these specifications.

C. Materials not in compliance with the specified requirements will be rejected

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected. Beginning of installation means that the installer accepts the existing conditions.

3.02 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Clean all bearing surfaces of debris and foreign matter.

E. Verify bearing surface is smooth and flat.

F. Bear decking on steel supports with 1 1/2 inch (38 mm) minimum bearing.

G. Provide decking free of amounts of lubricants or oils which would impair the adhesion of spray on fireproofing or painting.

H. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

I. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

J. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

K. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

L. Fasten deck to cold-formed steel support members at ends and intermediate supports with Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter at 12 inches on center maximum, parallel with the deck flute and at each transverse flute.

M. Mechanically fasten male/female side laps at 24 inches on center maximum for decking thinner than 20 gauge. Weld male/female side laps at 18 inches on center maximum for decks 20 gauge and heavier.

N. Reinforce steel deck openings from 6 to 18 inches (150 to 460 mm) in size with 2 inches x 2 inches x 1/4 inch (50 mm x 50 mm x 6 mm) steel angles. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fasten to deck at each flute.

O. Install 6 inch (150 mm) minimum wide sheet steel cover plates, of same thickness as decking, where deck changes direction. Fusion weld 12 inches (300 mm) on center maximum.

P. Install sheet steel closures and angle flashings to close openings between deck and walls, columns and openings.

Q. Install single row of foam flute closures above walls and partitions perpendicular to deck flutes.

R. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.03 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to cold-formed steel supporting members by corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum, and as follows:

1. Fastener Diameter: No. 10 (4.8-mm), nominal.
2. Fastener Spacing: Fasten edge and interior ribs of deck units with a minimum of two fasteners per deck unit at each support. Space fasteners 12 inches (305 mm) apart in the field of roof and 6 inches (150 mm) apart in roof corners and perimeter based on roof-area definitions in FMG Loss Prevention Data Sheet - FM DS 1-28.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 12 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches (51 mm) minimum.

D. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

E. Install sheet steel closures and angle flashings to close openings between deck and walls, columns and openings.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.05 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Pitched roof rafters.
2. Stud wall framing.
3. Flat ceiling and attic floor joist framing.
4. Joist framing.
5. Collar ties.
6. Parapet framing and bracing.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
3. The design of the cold-formed steel framing shall be the responsibility of the contractor’s fabricator. The sizes (depth) of the steel studs shall be as shown on the contract drawings. Unless specifically indicated on the construction documents, it shall be the responsibility of the design engineer to size the spacing and gauge of the element as well as the total depth of the member in the case of header and sill design.
4. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. The contractor’s fabricator shall provide a full set of engineering calculations as well as a complete set of shop drawings affixed with a New York State Professional Engineer’s sign and seal. The design of the cold-formed steel elements shall be in conformance with the information shown on the contract documents and shall be in accordance with the 2025 Building Code New York State.

C. Fabrication Drawings:

1. Prior to fabrication submit fabrication and erection drawings for review and approval by the architect/ engineer. Indicate component details, framing for openings, bearing anchorage, temporary bracing, welds or type and location of mechanical fasteners and accessories or items required of other work for complete installations. Included manufacturer's instructions for securing studs to tracks and for other framing connections.
2. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

D. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E329 to conduct the testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

D. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

E. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.01 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. ClarkDietrich Building Systems, LLC.
   2. MarinoWARE
   3. Architect/ Engineer approved equivalent.

2.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
   1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft.

2.03 COLD-FORMED STEEL FRAMING, GENERAL

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.
B. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: ST33H.
   2. Coating: G90 or equivalent.
C. Steel Sheet for Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: 50, Class 1 or 2.
   2. Coating: G90.
D. All studs and/or joists and accessories shall be the type, size, gage, and spacing shown on the plans. Studs, runners (track) bracing, and bridging shall be manufactured per ASTM C955.
E. All galvanized studs, joists, and accessories shall be formed from steel that conforms to the requirements of ASTM A653/A653M, as set forth in Section 1.02 of the AISI specification for design of cold-formed steel structural members.
F. All galvanized studs joists and accessories shall have a minimum G60 coating.
G. Minimum steel gauges shall be 18 gauge for all structural elements subject to gravity and/or lateral wind forces.
H. Minimum steel gauge for interior elements subject to partition loadings shall be 20 gauge.
I. All section properties shall be calculated in accordance with the AISI specification for the design of cold-formed steel structural members (latest edition).

J. Facing materials may not be substituted for bridging. Horizontal bridging must be installed prior to loading the wall and/or floor/roof joists.

K. The physical and structural properties published by approved supplier will be accepted; otherwise these properties must be substantiated by calculations for loading stresses and deflections of the designed framing sealed by a professional engineer licensed in the State of New York.

L. Prior to fabrication submit fabrication and erection drawings for review and approval by the architect/ engineer. Indicate component details, framing for openings, bearing anchorage, temporary bracing, welds or type and location of mechanical fasteners and accessories or items required of other work for complete installations. Included manufacturer's instructions for securing studs to tracks and for other framing connections.

2.04 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.033 inch, 20 gauge.
2. Flange Width: 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, un-punched, with un-stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch, 18 gauge.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ClarkDietrich Building Systems, LLC.
   b. MarinoWARE
   c. Steel Network, Inc. (The).

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; un-punched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch, 18 gauge.
2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.

2.05 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch, 18 gauge or as indicated on the construction documents..

2. Flange Width: 2 inches, minimum.

2.06 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Stud kickers and knee braces.
7. Hole reinforcing plates.
8. Backer plates.

2.07 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488/E488M conducted by a qualified testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

G. Column Flange Grip Clips: Pre-manufactured Column/Beam connectors for rapid installation of board type materials to Steel Column and Beam Flanges. ASTM A1003/A1003M Structural Grade 33 (230) Type H, ST33H (ST230H): 33ksi (230MPa) minimum yield strength, 45ksi (310MPa) minimum tensile strength, 27mil minimum thickness (22 gauge, 0.0283” design thickness) with ASTM A653/A653M G60 (Z180) hot dipped galvanized coating. Manufacturer: The Steel Network, Inc. Unit connection box measures 1 inch deep, 2 inches wide and 2 1/2

inches long with a spring clip depth of 2.375 inches and a curved clip spring clearance of .2 inches.

1. Install as indicated on the drawings. Maximum spacing 24 inches on center.

2.08 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M.

B. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C1107/C1107M, with fluid consistency and 30-minute working time.

C. Shims: Load bearing, high-density multimonomer plastic, and non-leaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.09 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.02 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.03 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work. Welds may be butt, fillet, spot or groove type. The appropriateness of which shall be determined by and within the design calculations. All welds shall be touched-up using zinc -rich paint to galvanized members and paint similar to that used by the manufacturer for painted members.
    b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

F. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

G. Install insulation, specified in Section 072100 - THERMAL INSULATION in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

I. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

J. Wire tying in structural applications is not permitted.

3.04 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches unless indicated otherwise.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to infill studs and anchor to building structure.
4. Connect drift clips to cold formed metal framing and anchor to building structure

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   a. Install solid blocking at centers indicated on Shop Drawings.
2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.05 FIELD QUALITY CONTROL

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

B. Field and shop welds will be subject to testing and inspecting.

C. All members shall be checked for proper alignment, bearing, completeness of attachments, proper placement and reinforcing.

D. Testing agency will report test results promptly and in writing to Contractor and Architect.

E. Remove and replace work where test results indicate that it does not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.06 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

3.07 TOLERANCES

A. Vertical alignment (plumbness) of studs shall be within 1/8 inch in 4 feet of the span.

B. Horizontal alignment (levelness) of walls shall be within 1/8 inch in 4 feet of their respective lengths.

C. Spacing of studs shall not be more than +1/8 inch from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.

END OF SECTION

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SECTION 055050 - Metal Fabrications **H2M**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Steel framing and supports for applications where framing and supports are not specified on other sections.
   2. Aluminum framing and supports for applications where framing and supports are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:
   1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.03 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 metal fabrications that are anchored to or that receive other work. 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.
   1. Provide templates for anchors and bolts specified for installation under other sections.
   2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by a Qualified Professional Engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Welding certificates.

C. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.06 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on the shop drawings.

1. Established dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond with established dimensions.
2. Provide allowance for trimming and fitting at the site.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum fabrications.

2.02 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.03 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners. (ASTM F 1941M)

B. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Anchors, General: 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/E 488M, conducted by a qualified independent testing agency.

D. Post-Installed Anchors: Torque-controlled expansion anchors and/or chemical anchors.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.04 MISCELLANEOUS MATERIALS

A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.05 FABRICATION, GENERAL

A. Shop Assembly: Pre-assemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form exposed work with accurate angles and surfaces and straight edges.

D. Weld corners and seams continuously 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

F. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

G. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

H. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.06 SHELF ANGLES

A. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.07 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.08 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12 or as selected by the architect from manufacturer's full color range.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. 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.

C. Field Welding: Comply with the following requirements:
   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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Pre-assembled steel stairs with concrete-filled treads.
   2. Steel tube railings attached to metal stairs.
   3. Steel tube handrails attached to walls adjacent to metal stairs.
   4. Wood blocking for anchoring railings.

1.03 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 (4.79 kN/sq. m).
   2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in (2580 sq. mm).
   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/360 or 1/4 inch (6.4 mm), whichever is less.

C. Structural Performance of Handrails and Railings: Handrails and railings shall withstand the structural loads required by ASCE 7 without exceeding the allowable design working stress of the materials for handrails, railings anchors and connections. Gravity loads and the following loads and stresses within the limits and under the conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
      b. Concentrated load of 200 lbf (0.89 kN) 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 (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).

D. Seismic Performance: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7, Minimum Design Loads for Buildings and Other Structures": Section 9 "Earthquake Loads".
   1. Component Importance Factor is 1.15.

1.04 ACTION SUBMITTALS

A. Product Data: For metal stairs and the following:

1. Refilled metal-pan stair treads.
2. Abrasive nosings.
3. Paint products.
4. Grout.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Provide templates for anchors and bolts specified for installation under other sections.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer.

B. Welding certificates. Certified welder employed on the work shall have AWS Certification within the previous 12 months.

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.

E. Special Inspection Requirements:

1. Where materials, welding procedures and qualifications of welders are verified prior to the start of work, periodic inspections of the work in progress and a visual inspection of all welds are made prior to shipping of shop welding, continuous special inspections of welding will not be required.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Professional Engineer Qualifications: A Professional Engineer who is legally qualified to practice in the state in which the project is located and who is experienced in providing engineering services of the type indicated and required for this section of the work. Engineering services are defined as those performed for installations of Metal Stairs including handrails and railing systems, that are similar to those indicated for this project in material, design and extent.

C. Fabricator Qualifications: A firm experienced in producing Metal Stairs similar to those indicated for this project and with a record of successful in-service performance, as well as sufficient production capability to produce the required units.

D. 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.
2. Ornamental Stairs: Architectural class.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

F. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code--Aluminum".

3. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.07 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

2.01 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.

2.02 FERROUS METALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Steel Tubing: ASTM A500/A500M (cold formed).

D. Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A1008M, either commercial steel, or structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.

2.03 ABRASIVE NOSINGS

A. Cast-Metal Units: Cast aluminum, with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. American Safety Tread Co., Inc.
   b. Balco Inc.
   c. Barry Pattern & Foundry Co., Inc.
   d. Safe-T-Metal Company, Inc.
   e. Wooster Products Inc.
2. Configuration: Cross-hatched units, 3 inches (75 mm) wide without lip.

B. Extruded Units: Aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Safety Tread Co., Inc.
      b. Balco Inc.
      c. Wooster Products Inc.

C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

D. Apply bituminous paint to concealed surfaces of cast-metal units set into concrete.

E. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.04 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, 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.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

D. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

E. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

F. 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 E488/E488M, conducted by a qualified independent testing agency.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 2 (A4) stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.05 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, non-gaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

D. Concrete Materials and Properties: Comply with requirements in Section {\id\#1000116} - {\t\#1000116} for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 4000 psi (20 MPa) unless otherwise indicated.

E. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and non-glazing; unaffected by freezing, moisture, or cleaning materials.

F. Welded Wire Fabric: ASTM A 185/A 185M, 6 by 6 inches (152 by 152 mm), W1.4 by W1.4, unless otherwise indicated.

2.06 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 (1 mm) 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 1 welds: no evidence of a welded joint.

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.

2.07 STEEL-FRAMED STAIRS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alfab, Inc.
2. American Stair, Inc.
3. Sharon Companies Ltd. (The).

B. Stair Framing:

1. Fabricate stringers of steel plates or channels tubes or a combination of both as indicated.
   a. Provide closures for exposed ends of channel or tube stringers.
2. Construct platforms of steel tube headers and miscellaneous framing members as indicated.
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 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 (1.7 mm).

1. Steel Sheet: Galvanized and primed cold-rolled steel sheet.
2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
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.
   a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.
6. When indicated, provide Hot-Dip galvanized completed fabrications with a factory primer ready for field painting.

2.08 STAIR RAILINGS

A. Comply with applicable requirements in Section 055213 - {\t\#1000126} or as indicated in this Section.

1. Rails may be bent at corners, rail returns, and wall returns, instead of using prefabricated fittings.
2. Connect posts to stair framing by direct welding unless otherwise indicated.

B. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.

1. Rails and Posts: 1-1/2-inch round top and bottom rails and 1-1/2-inch round posts.
2. Picket Infill: 1/2-inch round pickets spaced less than 3 7/8" inches clear.
3. Intermediate Rails Infill: 1-1/2-inch round intermediate rails spaced less than 21 inches clear or as shown on the drawings.
4. Gates: Form gates from steel tube of same size and shape as top rails, with infill to match guards. Provide with cam-type, self-closing hinges for fastening to wall and overlapping stop with rubber bumper to prevent gate from opening in direction opposite egress.

C. Welded Connections: Fabricate railings with 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. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.

D. Form changes in direction of railings as follows:
   1. As detailed.
   2. By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.

E. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

F. Close exposed ends of railing members with prefabricated end fittings.

G. 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 (6 mm) or less.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
   1. Connect posts to stair framing by direct welding unless otherwise indicated.
   2. For non-galvanized railings, provide non-galvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

2.09 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 6/NACE No. 3, "Commercial Blast Cleaning."
   1. Interior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

PART 3 - EXECUTION

3.01 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 {\id\#1000116} - {\t\#1000116}

1. Steel trowel concrete to a smooth finish, free of trowel marks and uniform in texture and appearance. allow concrete to cure for three days. Do not allow traffic on concrete.
2. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

3.02 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.

B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonmetallic, nonshrink grout unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.03 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

1. Anchor posts to steel by welding directly to steel supporting members.
2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

B. Attach handrails to wall with wall brackets. Use type of bracket with predrilled hole for exposed bolt anchorage. Provide bracket with 1-1/2-inch (38-mm) 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. Secure wall brackets 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 toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.04 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 (0.05-mm) 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 099113 - EXTERIOR PAINTING and Section 099123 - INTERIOR PAINTING

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Treated Wood Members.
2. Fasteners.
3. Wood blocking, cants, and nailers.
4. Wood furring and grounds.

1.03 REFERENCES:

A. AITC - American Institute of Timber Construction.

B. APA PRP-108 - Performance Standards and Qualification Policy for Wood Structural Panels (Form E445); 2021.

C. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions; 2012a (Reapproved 2018).

D. ASTM D5456 - Standard Specification for Evaluation of Structural Composite Lumber Products; 2021, with Editorial Revision.

E. AWPA U1 - Use Category System: User Specification for Treated Wood; 2022.

F. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. PS 1 - Structural Plywood; 2009 (Revised 2019).

H. PS 2 - Performance Standard for Wood Structural Panels; 2018.

1.04 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Lumber grading agencies, and the 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.

1.05 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.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.06 INFORMATIONAL SUBMITTALS

A. Material Certificates: 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. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Plywood.
4. Shear panels.
5. Power-driven fasteners.
6. Powder-actuated fasteners.
7. Expansion anchors.
8. Metal framing anchors.

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications: 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.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle, Transport and Store Plywood Panels in accordance with the APA Storage and Handling recommendations.

B. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship" for the following:
   1. Dimension lumber framing.
   2. Miscellaneous lumber.

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded 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 or omit grade stamp and provide certificates of grade compliance issued by grading agency.
   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 lumber.
   4. Provide dressed lumber, S4S, unless otherwise indicated.

C. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness 15 percent for 2-inch nominal thickness or less, no limit for more than 2-inch nominal thickness unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; UC2 (Interior Construction - Above Ground - Damp) for interior construction not in contact with the ground, Use Category UC3B (Above Ground Exposed) for exterior construction not in contact with the ground, and UC4B (Ground Contact or Fresh Water - Heavy Duty) for items in contact with the ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
   2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying 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 beyond the centerline of the burners at any time during the test.

1. Use treatment that does 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. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency. Mark panels on surfaces that will not be exposed in the final construction.

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, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings, and the following:

1. Concealed blocking.
2. Framing for non-load-bearing exterior walls.
3. Roof construction.

2.04 DIMENSION LUMBER FRAMING

A. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Species and Grade: Southern pine; No. 1 grade; SPIB.
2. Species and Grade: Douglas fir-south; No. 1 grade; WWPA.

3. Species and Grade: Hem-fir; No. 1 grade; WCLIB or WWPA.

2.05 CONSTRUCTION MOUNTING PANELS

A. Communications and Electrical Room Mounting Boards: PS 1, APA rated A-D faced plywood or MDF; 3/4 inch thick; flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.06 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Grounds.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:
   1. Hem-fir (north); NLGA.
   2. Mixed southern pine; SPIB.
   3. Hem-fir; WCLIB or WWPA.
   4. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
   1. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
   2. Eastern softwoods; No. 2 Common grade; NeLMA.

D. 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.

E. 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.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.07 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   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 Type 304 stainless steel.

B. Power-Driven Fasteners: NES NER-272.

C. Wood Screws: ASME B16.1.

D. Lag Bolts: ASME B18.2.1.

E. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers.

F. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E488/E488M conducted by a qualified independent testing and inspecting agency.

1. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.08 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

B. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION OF SURFACES

A. Surfaces to receive new wood members shall be free of all dirt, debris, and loose materials. Exposed surfaces shall be mechanically scraped if necessary, to remove projections.

B. Surfaces shall have no free water present in any form (rain, dew, frost, snow or ice).

C. Contractor is responsible to inspect all exposed surfaces to see that conditions are satisfactory for installation of new work.

3.02 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Place horizontal members flat, crown side up.

C. Coordinate installation of adjacent construction.

D. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

E. Do not splice structural members between supports unless otherwise indicated.

F. 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 o.c.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
   1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
   2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
   3. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.10.1, "Fastening Schedule," in ICC's "International Building Code" and the 2020 Building Code of New York State".

3.03 WOOD GROUND, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or 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. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.04 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

END OF SECTION

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PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Agreement, including General and Supplementary Conditions, and Division 01 of the Project Manual, apply to work of this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Gypsum sheathing at roof side of parapets.
   2. Sheathing in areas of vertical membrane roofing.

1.03 REFERENCES

A. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

B. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018.

C. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

D. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

E. GA-216 - Application and Finishing of Gypsum Panel Products; 2021.

F. GA-600 - Fire Resistance and Sound Control Design Manual; 2021.

G. GA-253 "Recommended Specifications for the Application of Gypsum Sheathing".

1.04 SUBMITTALS

A. Pursuant to Section 013300 - Submittal Procedures.

B. Pursuant to Section 016100 - Product Requirements.

C. Product Data:
   1. Submit manufacturer's product data for each type of exterior gypsum sheathing indicating where each type will be used.
   2. Submit fastener data as recommended by exterior gypsum sheathing manufacturer and as specified herein.

D. Warranty:
   1. Submit sample warranties for all warranty requirements specified in he Warranty paragraph below.

1.05 QUALITY ASSURANCE

A. Experienced workers familiar with the work and according to manufacturer’s recommendations and/or industry standards shall perform all work of this section.

B. All work of this section shall conform to industry standards and/or manufacturer's recommendations.

C. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

D. Fire-Test-Response Characteristics: Where fire-rated gypsum board assemblies are indicated, provide gypsum board assemblies that comply with the following requirements:

1. Fire Resistance Ratings: As indicated by reference to GA File Numbers in GA-600 "Fire Resistance Design Manual" or design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Gypsum board assemblies indicated are identical to assemblies tested for fire resistance according to ASTM E119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Pursuant to manufacturers published instructions.

B. All materials shall be delivered in their original unopened packages and stored in an enclosed shelter providing protection from damage and exposure to the elements.

C. Neatly stack gypsum panels flat to prevent sagging.

1.07 WARRANTY

A. Provide products that offer twelve months of coverage against in-place exposure damage (delamination, deterioration and decay).

B. Manufacturer's Warranty:

1. Five (5) years against manufacturing defects.

PART 2 PRODUCTS

2.01 MATERIALS

A. Gypsum Sheathing - Cavity Wall

1. Glass-Mat Gypsum Board: Gypsum board designed as an exterior substrate for a weather barrier, consisting of a noncombustible water-resistant core, essentially gypsum, surfaced with glass mats on face and back, partially or completely embedded in core, and with unsurfaced square edges. Comply with ASTM C1177/C1177M and requirements below.
   a. Type: X
   b. Thickness: 5/8 inch
2. Products: Subject to compliance with requirements, gypsum sheathing boards that may be incorporated in the Work include, but are not limited to, the following:
   a. Dens-Glass® Gold Exterior Sheathing; Georgia-Pacific Gypsum LLC
   b. GlasRoc® Sheathing; CertainTeed
   c. Fiberock® Aqua-Tough Sheathing; U.S. Gypsum Company
3. Sheathing fasteners: ASTM C954, steel drill screws, Type S-12 fluted tip, a minimum of 1-¼ inches long with organic polymer coating or other corrosion-protective coating.

B. Gypsum Sheathing to receive roofing material:

1. On the roof side of framed parapets and other vertically framed areas where sheathing will be covered by roofing materials use fiberglass-mat faced gypsum roof board.
    a. Thickness: 5/8 inch
    b. Weight: 2.55 psf.
    c. Surfacing: Fiberglass mat with non-asphaltic coating.
    d. Flexural Strength, Parallel (ASTM C 473): 100 lbf, minimum
    e. Flute Span (ASTM E 661) 8 INCHES.
    f. Permeance (ASTM E 96): Not more than 32 perms
    g. R-Value (ASTM C 518): Not less than 0.67
    h. Water absorption (ASTM C 1177): Less than 10 percent of weight.
    i. Compressive Strength (Applicable Sections of ASTM C 472): 500 to 900 pounds per square inch.
    j. Surface Water Absorption (ASTM C 473): Not more than 2 grams.
    k. Acceptable products:
        1) DensDeck Prime, Georgia-Pacific Gypsum.
        2) Architect approved equivalent
2. Sheathing fasteners: ASTM C 954, steel drill screws, Type S-12 fluted tip, a minimum of 1-¼ inches long with organic polymer coating or other corrosion-protective coating.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

D. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.02 SHEATHING INSTALLATION

A. Comply with ASTM C1280, GA-253 and manufacturer's written instructions. Erect gypsum sheathing pursuant to GA-216 and fasten at 6" o.c. along panel edge locations and 12" o.c. field locations with 1 ¼" S #6 screws.
    1. Fasten sheathing to cold-formed metal framing with screws.
    2. Install boards with a 3/8-inch gap where non-load bearing construction abuts structural elements.
    3. Install boards with a ¼ inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Horizontal Installation: Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each stud.
   1. Space fasteners approximately 6 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
   2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
   1. Space fasteners approximately 6 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
   2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

E. Do not bridge building expansion joints; cut and space edges of gypsum sheathing to match spacing of structural support elements.

3.03 PROTECTION

A. Protect gypsum sheathing and gypsum roof board until covered.

B. Replace broken or damaged sheathing.

C. Apply permanent or temporary covering within manufacturer’s stated exposure limits.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Cold-applied, emulsified-asphalt dampproofing.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.04 FIELD CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide molded-sheet drainage panels auxiliary materials recommended in writing by manufacturer of primary materials.

B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.

2.02 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. BASF Construction Chemicals - Building Systems; Sonneborn Brand Products.
   2. ChemMasters, Inc.
   3. Euclid Chemical Company (The); an RPM company.
   4. Henry Company.
   5. Karnak Corporation.
   6. Koppers Inc.
   7. Meadows, W. R., Inc.

B. Trowel Coats: ASTM D1227, Type II, Class 1.

C. Fibered Brush and Spray Coats: ASTM D1227, Type II, Class 1.

D. Brush and Spray Coats: ASTM D1227, Type III, Class 1.

2.03 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.

B. Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.

C. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C578, Type X, 1/2 inch thick.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.

B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

B. Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.

3.03 APPLICATION, GENERAL

A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.

1. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.

B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.

C. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.

D. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

3.04 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Concrete Foundations: Apply two brush or spray coats at not less than 1.5 gal. /100 sq. ft. for first coat and 1 gal. /100 sq. ft. for second coat one fibered brush or spray coat at not less than 3 gal. /100 sq. ft.

3.05 INSTALLATION OF PROTECTION COURSE

A. Where indicated, install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.
   1. Support protection course over cured coating with spot application of adhesive type recommended in writing by protection-board manufacturer.
   2. Install protection course on same day of installation of dampproofing (while coating is tacky) to ensure adhesion.

3.06 CLEANING

A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Modified bituminous sheet waterproofing.
   2. Auxiliary Materials

1.03 REFERENCE STANDARDS

A. ASTM C836/C836M - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course; 2018 (Reapproved 2022).

B. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

C. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2018).

D. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting; 2018.

E. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2017).

F. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

G. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2005 (Reapproved 2017).

H. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method; 1983 (Reapproved 2018).

I. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes; 2020.

J. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022.

K. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover; 2008a (Reapproved 2019).

L. ASTM D 1876 Standard Test Method for Peel Release of Adhesives (T-Peel).

M. ASTM D 1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

N. ASTM D 3767 Standard Practice for Rubber - Measurements of Dimensions

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Submit manufacturer’s product data, installation instructions, use limitations and recommendations, include certification of data indicating VOC (Volatile Organic Compound) content of all components of waterproofing system. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
   2. Submit manufacturer's written instructions for evaluating, preparing, and treating substrate.
B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
   1. Submit setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
B. Field quality-control reports.
C. Sample Warranties: For special warranties.

1.07 QUALITY ASSURANCE

A. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of self-adhesive sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.
B. Installer: A firm which has at least 3 years experience in work of the type required by this section. A firm that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer’s instructions, recommendations and material safety data sheets. Protect

materials from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

1. Do not double-stack pallets of membrane on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
2. Protect mastic and adhesive from moisture and potential sources of ignition.
3. Store drainage composite or protection board flat and off the ground. Provide cover on top and all sides.
4. Protect surface conditioner from freezing.

B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.09 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.
2. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, from single source from single manufacturer.

2.02 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: Minimum 60-mil (1.5-mm) nominal thickness, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated on one side to a 4-mil- (0.10-mm-) thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Grace Construction Products; W.R. Grace & Co. -- Conn; Bituthene 4000.
   b. Carlisle Coatings & Waterproofing Inc; CCW MiraDRI 860/861.
   c. Henry Company; Blueskin WP 100/200.
2. Physical Properties:
   a. Tensile Strength, Membrane: 325 psi (1.7 MPa) minimum; ASTM D412, Die C, modified.

b. Ultimate Elongation: 300 percent minimum; ASTM D412, Die C, modified.
c. Low-Temperature Flexibility: Pass at minus 45 deg F (minus 43 deg C); ASTM D1970/D1970M.
d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C836/C836M.
e. Puncture Resistance: 50 lbf (222 N) minimum; ASTM E154/E154M.
f. Water Absorption: 0.1 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D570.
g. Water Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m) maximum; ASTM E96/E96M, Water Method.
h. Resistance to Hydrostatic Head: 231 ft of water (70 m)

2.03 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
   1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
B. Miscellaneous Materials: Surface conditioner, mastic, liquid membrane, tape and accessories specified or acceptable to manufacturer of sheet membrane waterproofing.
C. Primer: Liquid waterborne primer recommended for substrate by sheet-waterproofing material manufacturer.
D. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.
E. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.
F. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
G. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick, predrilled at 9-inch (229-mm) centers.
H. Waterstop: AdcorTM ES hydrophilic non-bentonite waterstop by Grace Construction Products for non-moving concrete construction joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.
   1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
   2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D4263.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D4258.

F. Bridge and cover expansion joints with overlapping sheet strips of widths according to manufacturer's written instructions.

G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D6135.

1. Install membrane strips centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of liquid membrane on horizontal inside corners and as follows:
    a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
    b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D6135.

3.03 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D6135.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).

D. Horizontal Application: Apply sheets from low to high points of walls to ensure that laps shed water.

E. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

F. Seal edges of sheet-waterproofing terminations with mastic.

G. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.

H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.

I. Immediately install protection course with butted joints over waterproofing membrane.

1. Board insulation may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.04 FIELD QUALITY CONTROL

A. Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish daily reports to Architect.

B. Owner will engage an independent testing agency to observe appliation of materials and test mil thockness.

C. Prepare test and inspection reports.

3.05 PROTECTION, REPAIR, AND CLEANING

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Protect installed board insulation from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Polyisocyanurate foam insulation with foil facers
2. Extruded Polystyrene foam board insulation.
3. Mineral-wool blanket insulation.
4. Vapor retarders.

1.03 ACTION SUBMITTALS

A. See Section 013300 - SUBMITTALS, for submittal procedures.

B. Product Data: For each type of product indicated.

C. Manufacturer's Certificate: Certify panels will conform to specified performance requirements.

1.04 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

B. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.05 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.06 PRE-INSTALLATION MEETING

A. Pre-Installation Meeting: Convene minimum one week prior to commencing Work of this section. Review installation procedures and coordination required with Related Work and include the following:

1. Participants: Authorized representatives of the Contractor, Architect, Installer, and Manufacturer.
2. Review wall assemblies for potential interference and conflicts and coordinate layout and support provisions for interfacing work.
3. Review continuous insulation wall panels installation methods and procedures related to application, including manufacturer’s installation guidelines.
4. Review firestopping requirements and weather resistive membrane requirements and placement locations.
5. Review field quality control procedures.

1.07 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 before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

C. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.01 POLYISOCYANURATE BOARD INSULATION

A. Acceptable Manufacturer: Insulating panels shall be XCI products produced by Hunter Panels, 15 Franklin Street, Portland, Maine 04101. Phone: (207) 761-5678 or (888) 746-1114. Fax: (877) 115-1769. E-mail: info@hpanels.com.

1. Architect approved equivalent.

B. Board Insulation with Foil Facers: Hunter Panels Xci Foil (Class A) complies with ASTM C1289 and ASTM E84 Class A (25 or less) Panels are a high thermal resistive rigid insulation panel composed of a closed cell polyisocyanurate foam core bonded on both sides to reinforced foil facers.

1. Type: ASTM C1289, Type I
   a. Grade 3 (25 psi).
   b. Panel Size:
      1) 4 feet by 8 feet (1220 mm by 2440 mm).
   c. R Value: ASTM C518 at 75 degrees F (23.9 degrees C). Provide thickness requirements indicated on the drawings
      1) 1.5 inches (38 mm) / R Value 9.5

C. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.

D. Panel fasteners shall be corrosion resistant type as approved by the panel manufacturer. Length of fasteners shall be as recommended by the panel manufacturer

2.02 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E84, Class A.
   1. Products:
      a. DuPont de Nemours, Inc. Chemical Company; STYROFOAM HIGHLOAD 100: www.DuPont.com/#sle.
      b. Owens Corning Corporation: FOAMULAR NGX 1000(100 psi compressive strength): www.ocbuildingspec.com/#sle.
      c. Substitutions: See Section 016100 - Product Requirements and Section 012500 - Substitution Procedures.
   2. Type V: 100.0 psi (Compressive strength), 3.00 pcf (Density) minimum.
   3. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
   4. Type and Thermal Resistance, R-value: Type V, 5.0, (0.88) per 1 inch thickness at 75 degrees F mean temperature.

B. Phenolic Foam Core Board Insulation: Phenolic foam core insulation boards with a glass-tissue-based facing on the back surface and a composite foil facer on the exterior surface. Provide type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Kingspan Kooltherm K12 Framing Board.
      b. Or approved equal.
   2. Compressive Strength: Minimum ASTM D1621. Compressive strength at 10% compression:100 kPa (14.5 psi) min.

C. Rigid Vacuum-sealed Insulation Panel encased and sealed in a thin gas-tight envelope providing high thermal resistance with reduced panel thickness requirements. System shall incorporate compatible rigid insulation panels for areas requiring panel modifications and/or penetrations to complete the thermal envelope. The installation shall be coordinated with the manufacturer's design support team to enable optimal and efficient use of the OPTIM-R panel systems.
   1. Panels shall be manufactured under a management system certifies the following:
      a. ISO 9001:2015 (Quality Management Systems, Requirements).
      b. ISO 14001:2015 (Environmental Management Systems, Requirements).
      c. ISO 45001:2018 (Occupational Health and Safety Management Systems, Requirements).
      d. ISO 50001:2018 (Energy Management Systems, Requirements).
   2. Panels shall meet the following ASTM standards:
      a. ASTM C1667
      b. ASTM C165
      c. ASTM D2126
   3. Physical Characteristics:

Property	Test Method	Result
Nominal Thickness		0.79 - 1.97 inches / 20 - 50 mm

Dimensions: Width Length		 11.8 - 23.6 inches / 300 - 600 mm 11.8 - 47.2 inches / 300 - 1200 mm
Nominal Panel Mass 20 mm thickness 25 mm thickness 30 mm thickness 35 mm thickness 40 mm thickness		 0.82 p.s.f. / 4 kg/sq.m. 1.02 p.s.f. / 5 kg/sq.m. 1.25 p.s.f. / 6 kg/sq.m. 1.43 p.s.f. / 7 kg/sq.m. 1.64 p.s.f. / 8 kg/sq.m.
Compressive Strength, Min. (psi) @ 10% deformation	ASTM C165	23
Dimensional Stability 20 mm (0.79 in.)-50 mm (1.97 in) Length max. Width max.	ASTM D2126	 0.5% 0.6%
Density	BS EN 1602	10.6-13.10 pcf / 170-210 kg/cm
Thermal Resistance (thickness) 0.79 in. / 20 mm 0.98 in. / 25 mm 1.18 in. / 30 mm 1.57 in. / 40 mm 1.97 in. / 50 mm	ASTM C1667	R - value (Avg. based on panel size) 22 28 33 46 57

4. Manufacturer / Product: Kingspan / OPTIM-R or Architect approved equivalent.

D. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

E. Tape joints in rigid insulation with Henry Blueskin SA or equivalent material as recommended by the approved insulation manufacturer.

2.03 MINERAL-WOOL BLANKET INSULATION

A. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.

1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
3. Products:
   a. Johns Manville; MinWool Sound Attenuation Fire Batts: www.jm.com/#sle.
   b. Knauf Insulation; EcoBatt Insulation: www.knaufinsulation.com/#sle.
   c. ROCKWOOL (ROXUL, Inc); AFB evo™: www.rockwool.com/#sle.
   d. Thermafiber, Inc; SAFB FF: www.thermafiber.com/#sle.

e. Owens Corning.- Thermafiber® RainBarrier HD (R-4.3 per inch, 6.0 pcf.)

4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 40 percent.

B. Mineral-Wool Blanket Wall Insulation: COMFORTBATT; ASTM C665, Class A (faced surface with a flame-spread index of 25 or less per ASTM E84);

1. Sizes: 16.25 inches x 48 inches (Metal Studs) as indicated on the drawings.
2. Thickness: 6 inches: R24 (Metal Studs) as required by the drawings.
3. Density:
   a. 2 pcf, ASTM C167.

2.04 VAPOR RETARDERS - LOW PERMEANCE

A. Reinforced-Polyethylene Vapor Retarders: Two outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb/1000 sq. ft., with maximum permeance rating of 0.0507 perm.

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. Raven Industries Inc.; DURA-SKRIM 6WW.
   b. Reef Industries, Inc.; Griffolyn T-65.
   c. Stego Industries, LLC StegoWrap 15 mil
   d. or approved equal.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

D. Single-Component Nonsag Urethane Sealant: ASTM C920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

E. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

F. Foil Type Wall Vapor Barriers: Foil faced, scrim-reinforced kraft Vapor Barrier material, ASTM C1136, Type II, IV; with 0.0003 inch Aluminum Foil face, 0.0001 inch Elastomeric Polymer Barrier Coating, Tri-directional fiberglass reinforcing, flame resistant adhesive and 0.01 lb. / sq. ft. Natural Kraft backing. Product shall be R-3035 Foil Scrim / Kraft as manufactured by Lamtec® Corporation or approved equal.

2.05 VAPOR RETARDER - VARIABLE PERMEANCE

A. Sheet Retarder: Certainteed MemBrain, The SMART Vapor Retarder. Polyimide film vapor retarder for use with unfaced, vapor permeable glass fiber and mineral wool insulation in wall and ceiling cavities. Material has a permeance of 1 perm or less when tested to ASTM E 86, dry cup method and increases to greater than 10 perms using the wet cup method.

1. Water Vapor Permeance:
   a. ASTM E 86, dry cup method: 1.0 perms (57ng/Pa*s*m2).
   b. ASTM E 86, wet cup method: 10.0 perms (1144ng/Pa*s*m2).
2. Fire Hazard Classification: ASTM E 84:

a. Maximum Flame Spread Index; 20.
b. Maximum Smoke Developed Index; 55.

2.06 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
   1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
   1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
      a. Ceiling plenums.

C. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 1 inch between face of insulation and substrate to which anchor is attached.

D. Insulation Fasteners: Lengths of galvanized, 13 gauge, 0.072 inch (1.83 mm) high carbon spring steel with chisel or mitered tips, held in place by tension, length to suit insulation thickness and substrate, capable of securely supporting insulation in place.

E. Insulation Fasteners: Impaling clip of galvanized steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

F. Wire Mesh: Galvanized steel, hexagonal wire mesh.

G. Adhesive: Gun grade, interior and exterior, and compatible with insulation and substrates; complies with ASTM C557.
   1. Application Temperature: 40 to 100 degrees F (5 to 38 degrees C) at contact surfaces.
   2. Volatile Organic Content (VOC): Less than 7 percent by weight.

H. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.02 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

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. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.03 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 48 inches in from exterior walls.

3.04 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Division 04

3.05 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Glass-Fiber or Mineral-Wool 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. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
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. 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.

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.06 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.07 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.08 INSTALLATION OF CURTAIN-WALL INSULATION

A. Install board insulation in curtain-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.

1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.
2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.

3.09 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. 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.

C. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.10 CLEANING

A. Progress Cleaning: Perform cleanup as work progresses in accordance with Section 011400 - WORK RESTRICTIONS and 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

B. Final Cleaning: Upon completion, remove surplus materials, rubbish, tools and equipment in accordance with Section 017423 - CLEANING.

C. Waste Management:

1. Coordinate recycling of waste materials with Section 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.11 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.02 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
   1. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm.

D. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture resistant, to the degree specified, intended to be installed to shed water without sealed seams.

1.03 REFERENCE STANDARDS

A. AATCC Test Method 127 - Test Method for Water Resistance: Hydrostatic Pressure; 2018, with Editorial Revision (2019).

B. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022.

F. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

G. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; 2016, with Editorial Revision (2019).

H. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; 2017.

I. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; 2015.

1.04 SUBMITTALS

A. See Section 013300 - {\t\#1000041}, for submittal procedures.

B. LEED Data Submissions: See Section 018113 - SUSTAINABILITY DESIGN REQUIREMENTS for required submittals.

C. Product Data: Provide data on material characteristics.

D. Shop Drawings: Provide drawings of special joint conditions.

E. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

F. Manufacturer's Installation Instructions: Indicate preparation.

G. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

H. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

I. Testing Agency Qualification Statement.

1.05 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/sle:

1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Water-Resistive Barrier: Provide on exterior walls under exterior cladding.

B. Air Barrier:

1. On outside surface of sheathing of exterior walls use air barrier coating.

C. Exterior Vapor Retarder:

2.02 WATER-RESISTIVE BARRIER MATERIALS (NEITHER AIR BARRIER NOR VAPOR RETARDER)

2.03 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier Sheet, Mechanically Fastened:

1. Air Permeance: 0.004 cubic feet per minute per square foot (0.02 L/s/sq m), maximum, when tested in accordance with ASTM E2178.

2. Water Vapor Permeance: 5 perms (286 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
3. Water Penetration Resistance: Withstand a water head of 21 inches (55 cm), minimum, for minimum of 5 hours, when tested in accordance with AATCC Test Method 127.
4. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for minimum of 180 days weather exposure.
5. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.
6. Water Resistance: Comply with applicable water-resistive requirements of ICC-ES AC38.
7. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches (50 mm) wide, compatible with sheet material; unless otherwise specified.
8. Products:
    a. DuPont Building Innovations; Tyvek Commercial Wrap D with Tyvek Fluid Applied Flashing - Brush Formulation, Tyvek Fluid Applied Flashing and Joint Compound, FlexWrap NF, StraightFlash, StraightFlash VF, Tyvek Wrap Caps, and Tyvek Tape: www.dupont.com.
    b. Or approved equal.

B. Air Barrier, Fluid Applied: Vapor permeable, elastomeric waterproofing.

1. Air Barrier Coating:
    a. Material: Acrylic.
    b. Air Permeance: 0.004 cubic feet per minute per square foot (0.02 L/s/sq m), maximum, when tested in accordance with ASTM E2178.
    c. Water Vapor Permeance: 5 perms (287 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M, Procedure B.
    d. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for minimum of 6 months weather exposure after application.
    e. Elongation: 300 percent, minimum, when tested in accordance with ASTM D412.
    f. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
    g. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
    h. VOC Content: 50 g per L or less.
    i. Code Acceptance: Comply with applicable requirements of ICC-ES AC212.
    j. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
    k. Products:
        1) Parex USA, Inc.; Parex USA WeatherSeal Spray & Roll-on: www.parexusa.com/sle.

2.04 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

2.05 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

C. Flexible Flashing: Sheathing fabric saturated with air barrier coating and complying with the applicable requirements of ICC-ES AC148.

1. Flexible Flashing: use flashing material as recommended by the approved Weather Barrier manufacturer for the various conditions encountered on the project. Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spun-bonded polyolefin to produce an overall thickness of not less than 64 mil.
    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1) DuPont (E. I. du Pont de Nemours and Company); DuPont Flashing Tape.
        2) Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Butyl Self Adhered Flashing.
    b. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

D. Liquid Flashing: One part, fast curing, non-sag, gun grade, trowelable liquid flashing.
    1. Products:
        a. Parex USA, Inc.; Parex USA WeatherTECH with WeatherFlash: www.parexusa.com/sle.

E. Thinners and Cleaners: As recommended by material manufacturer.

F. Fasteners: Provide corrosion resistant fasteners with plastic caps in types and sizes recommended by the approved Weather Barrier manufacturer for the type of construction (metal, wood or masonry) being utilized on the project.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Water-Resistive Barriers: Install continuous barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.

C. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

D. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

E. Mechanically Fastened Sheets - On Exterior:
    1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
    2. Overlap seams as recommended by manufacturer but at least 6 inches.

3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches (305 mm).
4. Attach to masonry construction using mechanical fasteners spaced at 12 to 18 inches (305 to 460 mm) on center vertically and maximum 24 inches (610 mm) on center horizontally.
5. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
6. Install water-resistive barrier over jamb flashings.
7. Install air barrier and vapor retarder UNDER jamb flashings.
8. Install head flashings under weather barrier.
9. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.

F. Coatings:

1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
2. Mastic Coating: Install by trowel or roller to minimum thickness of 1/4 inch (6 mm); use sheet seal to join to adjacent construction, seal air tight with sealant.
3. Use flashing to seal to adjacent construction and to bridge joints.

G. Openings and Penetrations in Exterior Weather Barriers:

1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto weather barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with at least 4 inches (100 mm) wide; do not seal sill flange.
3. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flashing at least 9 inches (230 mm) wide, covering entire depth of framing.
4. At head of openings, install flashing under weather barrier extending at least 2 inches (50 mm) beyond face of jambs; seal weather barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

A. See Section 014500 - QUALITY CONTROL, for additional requirements.

B. Coordination of ABAA Tests and Inspections:

1. Provide testing and inspection required by ABAA QAP.
2. Notify in ABAA writing of schedule for air barrier work. Allow adequate time for testing and inspection.
3. Cooperate with ABAA testing agency.
4. Allow access to air barrier work areas and staging.
5. Do not cover air barrier work until tested, inspected, and accepted.

C. Do not cover installed weather barriers until required inspections have been completed.

D. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

E. Take digital photographs of each portion of the installation prior to covering up.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

B. Do not leave paper- or felt-based barriers exposed to weather for longer than one week.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes:
   1. Standing-Seam Metal Roof Panels.
   2. Underlayment Materials.
   3. Miscellaneous Materials including:
      a. Panel Accessories
      b. Flashing & Trim
      c. Roof Curbs
      d. Fasteners
      e. Sealants
      f. Snow Guards.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
   1. Wind Loads: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.
   3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E1680 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft.

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 at the following test-pressure difference:
   1. Test-Pressure Difference: 2.86 lbf/sq. ft. for roof applications equal to or less than 30 degrees from horizontal and 6.24 lbf/sq. ft. for roof slopes steeper than 30 degrees from horizontal.

D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
   1. Uplift Rating: UL 90.
   2. Uplift Load: ASTM E1592.

E. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
   1. Fire/Windstorm Classification: Class 1A-90.
   2. Hail Resistance: MH (Moderate Hail).

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

G. Other Physical Characteristics:

1. Specular Gloss: ASTM D523
2. Pencil Hardness: ASTM D3363
3. T-Bend Flexibility: ASTM D4145
4. Mandrel Bend Flexibility: ASTM D522/D522M
5. Impact Resistance: ASTM D2794
6. Abrasion Resistance: ASTM D968
7. Acid Resistance: ASTM D1308
8. Acid Rain Resistance (Kesternich): ASTM G 87 or DIN 50018
9. Alkali Resistance, Sodium Hydroxide: ASTM D1308, Procedure 7.2
10. Salt Spray: ASTM B117
11. Cyclic Salt Spray: ASTM D 5894
12. Humidity Resistance: ASTM D2247
13. Accelerated Weathering: ASTM D822/D822M and ASTM G155
14. Color Retention, Florida Exposure: ASTM D2244
15. Chalking Resistance ASTM D4214
16. Air Infiltration: ASTM E283
17. Water Penetration: ASTM E331
18. Wind Driven Rain: TAS 100 AAMA 501.1
19. Fire Resistance: UL 790/ASTM E108
20. Impact Resistance: UL 2218

1.04 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 metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Coordination Drawings: Roof plans, drawn to scale, on which the following are shown and coordinated with each other, base don input from installer of the items involved:
   a. Roof panels and attachments
   b. Metal trusses, bracings and supports
   c. Roof-mounted items including snow guards and items mounted on roof curbs.
3. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
4. Engineering performed and certifiedby an Engineer licensed in the State in which the project will be constructed:
   a. Snow Calcs Required for Warranty

b. Wind Loads Required for Warranty

C. Samples for Initial Selection: For each type of metal 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. Metal Panels: 12 inches (305 mm) long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.05 INFORMATIONAL SUBMITTALS

A. Manufacturer Qualification Statement: Provide documentation showing metal roof panel fabricator is accredited under IAS AC472.

B. Qualification Data: For Installer.

C. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the manufacture of roofing systems similar to those required for this project.

1. Not less than 5 years of documented experience.
2. Accredited by IAS according to IAS AC472.

B. Test Reports: Indicate compliance of metal roofing system to specified requirements.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.08 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, and Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
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 metal 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 structural loading limitations of deck during and after roofing.
6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.

8. Review temporary protection requirements for metal panel systems during and after installation.
9. Review procedures for repair of metal panels damaged after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Ordering: Comply with manufacturer's ordering instruction and lead time requirements to avoid construction delays.

B. Deliver components, metal panels, underlayments and other manufactured items so as not to be damaged or deformed. Package metal panels, accessories, trims and underlayments for protection during transportation and handling. Follow all delivery, storage and handling requirements of the manufacturer.

C. Unload, store, and erect metal panels, accessories and trims in a manner to prevent bending, warping, twisting, and surface damage.

D. Store roll materials on end on a clean, flat and dry location raised above grade and out of direct sun and exposure to the elements until time of application.

E. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

F. Retain strippable protective covering on metal panels during installation.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.11 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including rupturing, cracking, or puncturing.
   b. Deterioration of metals and other materials beyond normal weathering.
2. Warranty Period: Two 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 metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion (including Coastal locations within 1500 feet of the Coastline).

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: Twenty (20) years from date of Substantial Completion.

D. Special Warranty for the ATA-Shield Material:

1. Warranty Period: Thirty (30) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1637.
2. Forming: Use continuous end rolling method. No end laps on panels.

B. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels <>: Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. ATAS International, Inc.; Dutch Seam Panel MRD (Basis of Design)
   b. Architect approved equivalent.
2. Aluminum Sheet: Coil-coated sheet, ASTM B209/B209M, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
   a. Thickness: 0.040 inch aluminum
   b. Surface: smooth panel.
   c. Exterior Finish: Kynar 500 PVDF, Two-coat fluoropolymer, AAMA 2605.

d. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss as selected by Architect from manufacturer's standard line.
   1) Sherwin Williams; Flurothane Coastal Premium Fluoropolymer (70% PVDF): www.coil.sherwin.com/#sle.

e. Color: As selected by Architect from manufacturer's full range.

3. Clips: Two-piece floating to accommodate thermal movement.
   a. Material: 0.064-inch nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
4. Joint Type: As standard with manufacturer.
5. Panel Coverage: 19 1/2 inch
6. Panel Seam Height: 2 inch.

2.02 UNDERLAYMENT MATERIALS

A. Felt Underlayment: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felts.

B. Synthetic Roof Underlayment: ATAS ATA-Guard Air, water and vapor barrier, reinforced, asphalt-free, UV resistant (6 months maximum), 30 mil thickness x 48 inch wide roll material in 250 foot length rolls. Each roll shall weigh 48 pounds. Gray color polymer material with a nodular texture to provide a walkable surface in wet conditions. Material shall be mechanically attached and lapped, fastened and layered as per manufacturers specifications to meet local building code requirements for indicated roof slope(s). Manufacturer: ATAS International, Inc. or Architect approved equivalent.

1. Material shall meet the following Physical Characteristics:
   a. Class A fire: ASTM A108
   b. Nail Sealability ASTM D1970/D1970M
   c. Permeability 0.05 perms ASTM E96/E96M
   d. Water Transmission ASTM D4869/D4869M
   e. Tear Strength MD 55 lbs, CD 55 lbs ASTM D226/D226M
   f. Tensile Strength, MD 178 lbs, ASTM D751
   g. Weight per Square 4.7 lbs ASTM D5261
   h. Minimum Thickness 30 mils ASTM D1777

C. Self-Adhering, High-Temperature Underlayment: Provide ATAS ATA-Shield self-adhering, cold-applied, sheet underlayment, a minimum of 45 mils thick, consisting of slip-resistant, un-reinforced polymer -modified bitumen material adhered to the underside of a polymer-coated synthetic woven material. Material is 3 foot wide in 72 length rolls weighing 48 pounds. Each roll covers 200 square feet of roof surface. Manufacturer: ATAS International, Inc. or approved equal.

1. Material shall meet the following Physical Characteristics:
   a. Tensile Strength, Self Seal Ability ASTM D1970/D1970M
   b. Permeability, 0.1 perms maximum ASTM E96/E96M
   c. Water Transmission ASTM D4869/D4869M
   d. Tear Resistance, 20 lbf ASTM D4073/D4073M

e.	Tensile Strength, MD 140 lbs,	ASTM D751
f.	Weight per Square 2.4 lbs	ASTM D5261
g.	Minimum Thickness 45 mils	ASTM D5147/D5147M
h.	Adhesion to plywood	ASTM D903

2.03 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Sub framing 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) coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including but not limited to: z closures, edge and starter cleats, joggle cleats, pop rivets, crickets, sealants, gaskets, filler strips, and closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closure Strips: Closed-cell, expanded, cellular, rubber or cross-linked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or Premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eave trim, shed ridge trim, sidewall trim, step flashing, base flashing, counterflashing, valley flashing , z closures, fascias, and crickets. Finish flashing and trim with same finish system as adjacent metal panels.

D. Roof Curbs: Fabricated from same material as roof panels, 0.048-inch (1.2-mm) nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of 0.060-inch- (1.52-mm-) nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.

1. Insulate roof curb with 1-inch (25-mm-) thick, rigid insulation minimum.

E. Panel Fasteners: Self-tapping screws designed to withstand design loads.

F. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

G. Seam-Mounted, Rail-Type Snow Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Alpine SnowGuards; a division of Vermont Slate & Copper Services, Inc
   b. Architect approved equivalent.
3. Description: Snow guard rails fabricated from metal pipes, bars, or extrusions, anchored to brackets and equipped with two rails with color-matching inserts of material and finish used for metal roofing.

2.04 FABRICATION

A. General: Fabricate and finish metal 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. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal 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.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and 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. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

2.05 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 unacceptable. 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. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coats <>. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Note: Provide Fluorthane Coastal primer and 70 % PVDF Premium Fluoropolymer finish for projects within 1500 feet of the Coastline.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
   1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
   2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof 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 systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.03 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
   1. Apply over the roof area indicated below:
      a. Roof perimeter for a distance up from eaves of 36 inches beyond interior wall line.
      b. Valleys, from lowest point to highest point, for a distance on each side of 18 inches. Overlap ends of sheets not less than 6 inches.
      c. Rake edges for a distance of 18 inches.
      d. Hips and ridges for a distance on each side of 12 inches.
      e. Roof-to-wall intersections for a distance from wall of 18 inches.

f. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of 18 inches.

B. Underlayment: Apply at locations indicated below, in shingle fashion to shed water, and with lapped joints of not less than 3 inches.

1. Apply on roof not covered by self-adhering sheet underlayment. Lap over edges of self-adhering sheet underlayment not less than 4 inches, in shingle fashion to shed water.

C. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

D. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 - {\t\#1000260}.

3.04 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal 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 metal 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 metal 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 metal 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. Exposed pop-rivets shall be finished to match panel materials.

C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Watertight Installation:
   a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.

b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

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 metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and 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 will be permanently watertight and weather resistant.

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 achieve waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of inter meshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 30 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion. See Section 077123 - {\t\#1000266}.

I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

J. Roof Curbs: Install flashing around bases where they meet metal roof panels.

K. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.05 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.06 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.07 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured metal panels for soffits, with related flashings and accessory components.

1.02 REFERENCE STANDARDS

A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

1.03 SUBMITTALS

A. See Section 013300 - SUBMITTALS, for submittal procedures.

B. Shop Drawings: Indicate dimensions, layout, joints, construction details, methods of anchorage, and reflected soffit plans indicating material type, seami direction and locations and finishes.

C. Samples: Submit two samples of wall panel and soffit panel, by 18 inch (457.2 mm) in size or one complete 12 inch long section of panel illustrating finish color, sheen, and texture.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.

B. Installer Qualifications: Company specializing in installing the products specified in this section with minimum five years of documented experience.

C. Source Limitations: Obtain all components from a single manufacturer. Secondary products that are required shall be recommended and approved in writing by the Manufacturer.

1. Upon request of the Architect or Owner, submit Manufacturer’s written approval of secondary components in list form, signed by an authorized agent of the Manufacturer.
2. Manufacturer shall have direct authority and control over all fabrication of steel components as well as the raw materials used in their fabrication.

1.05 MOCK-UP

A. Construct mock-up, 12 feet (3.66 m) long by 8 feet (2.44 m) wide or as directed by the Architect; include panel system, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, related insulation, and connections to adjoining materials in mock-up.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer’s responsibilities:
   1. All panels shall be shipped from the manufacturer with polystyrene or similar cushioned packaging material separating the individual panels to minimize flexing, stressing, scratching or otherwise damaging the material during transit to the job.
   2. Fully cover materials with tarpaulins or similar protective cover during transit to prevent dirt and debris from coming in contact with the finished goods.
B. Inspect materials upon delivery. Reject and remove physically damaged or marred material from project site.
C. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
D. Store prefinished material off ground and protected from weather. Prevent twisting, bending, or abrasion, and provide ventilation to stored materials. Slope metal sheets to ensure drainage.
E. Prevent contact with materials that may cause discoloration or staining of products.

1.07 WARRANTY

A. See Section 017800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.
B. Correct defective Work within a five year period after the Date of Substantial Completion, including defects in water tightness and integrity of seals.
C. Additional Special Warranties:
   1. Manufacturer’s standard twenty (20) year finish warranty covering checking, crazing, peeling, chalking, fading, or adhesion.
   2. Installer’s two (2) year warranty covering panel system installation.
D. Warranties shall commence on date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Soffit Panels:
   1. ATAS International, Inc: www.atas.com/sle.
   2. Architect approved equivalent.
   3. Substitutions: See 012500 - WOOD I-JOISTS.

2.02 MANUFACTURED SOFFIT PANELS

A. Soffit Panels:
   1. Profile: Opaline OPF (Flush) Interlocking joints.
   2. Material: ASTM B209, 3105-H14 alloy, solid and perforated precoated aluminum sheet, 18 gauge, 0.0403 inch (1.02 mm) minimum thickness. Locate perforated (vented) panels where indicated on the drawings.
   3. Exposed face width: 8 inch.
   4. Panel Depth: 3/4 inch
   5. Panel Texture: Smooth
   6. Perforations: Microperforated
   7. Color: As selected by Architect/Engineer from manufacturer's full line.

B. Subgirts:
   1. 18 gauge, 0.0403 inch (1.02 mm) thick formed aluminum sheet.
   2. Profile as indicated; to attach panel system to building.

C. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.
   1. Provide mitered internal corners, back braced with 18 gage, 18 inch (457.2 mm) thick precoated metal sheet to maintain continuity of profile.

D. Expansion Joints: Same material, thickness and finish as exterior sheets; 18 gage, 18 inch (457.2 mm) thick; manufacturer's standard brake formed type, of profile.

E. Trim, Closure Pieces, Flashings, and flat stock material: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

F. Anchors: Aluminum or Stainless steel.

2.03 MATERIALS

A. Precoated Aluminum Sheet: ASTM B209 (ASTM B209M), 3105 alloy, H14 smooth surface texture; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.04 ACCESSORIES

A. Sealants:
   1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
   2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
   3. Color: Color of sealants shall match the approved panel color unless directed otherwise by the Architect.

B. Fasteners: Manufacturer's standard type to suit application; stainless steel. Exposed fasteners same finish as panel system.
   1. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws.
   2. Products:
      a. ITW Commercial Construction North America; Teks Select Series: www.ITWBuildex.com.

C. Field Touch-up Paint: As recommended by panel manufacturer.

D. Bituminous Paint: Asphalt base.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

B. Verify that weather barrier has been installed over substrate completely and correctly.

3.02 PREPARATION

A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane. Space at intervals indicated.

3.03 INSTALLATION

A. Install panels on soffits in accordance with manufacturer's instructions.

B. Manufacturer shall provide all details on their shop drawings provided to the contractor; the manufacturer approved installation contractor shall install soffit and flashings in accordance with approved shop drawings and manufacturer’s product data, within specified erection tolerances.

C. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.

D. Install metal soffit panels over over the completed soffit substrate fastened into the structural substrate with compatible / non-corrosive screw type fasteners at twelve (12) inches o.c. maximum spacing along each panel seam, unless a closer spacing is required by the manufacturer to meet local wind loading conditions.

E. Fasten panels to structural supports; aligned, level, and plumb.

F. Locate joints over supports. Lap panel ends minimum 2 inches (51 mm).

G. Provide expansion joints where indicated.

H. Coordinate flashing and sheet metal work to provide weathertight conditions at soffit terminations. Fabricate and install in accordance with standard of SMACNA Manual.

I. Use concealed fasteners unless otherwise approved by Architect/Engineer.

J. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.04 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch (1.6 mm).

B. Maximum Variation from Plane or Location Indicated on Drawings: 1/8 inch (3.2 mm).

3.05 CLEANING

A. Remove site cuttings from finish surfaces.

B. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water in accordance with the manufacturer's directions.

C. Replace damaged work than cannot be restored by normal cleaning methods.

D. Upon completion of installation, thoroughly clean prefinished aluminum surfaces in accordance with AAMA 609 & 610.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Fleece Backed ethylene-propylene-diene-monomer (EPDM) roofing system.
   2. Roof Edge systems.
   3. Roof Coping systems
   4. Vapor retarder.
   5. Roof insulation.

1.03 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.04 SUBSTITUTIONS / OR EQUALS

A. Substitutions or Equals for the roofing material manufacturer and items listed in this specification shall be submitted in conformance with Division 1 and as otherwise modified by the following:
   1. A proposed Substitution/or Equal submission package must be submitted to the Architect no later than ten (10) business days prior to the bid date. Otherwise, any Substitution/or Equal other than the manufacturer specified will not be considered.
   2. Submittal to Architect must include:
      a. Identification of Project - Project Name;
      b. Name of Submitting Bidder;
      c. Telephone and Email address of Submitting Bidder;
      d. Manufacturer’s Name of Proposed or Equal/Substitution;
      e. Model, line or material type;
      f. Equivalent line by line item comparison for each item listed in the materials section of this specification, including each of the optional accessories. Note: Each proposed item must have proposed manufacturer and model/product numbers.
      g. Addresses of two locations within 30 miles of the proposed site, where the proposed Substitution/or Equal manufacturer has installed their similar roofing product and name and telephone number of a contact person to be able to arrange a site visit.
      h. A copy of the final signed warranty signed and issued by the manufacturer for the two projects provided.
   3. Partial and/or Failure to follow any of the procedures outlined in division 1 or above may subject the entire submission for rejection.
   4. Incomplete submissions may not be reviewed.
   5. Substitution/ or Equals if found acceptable will be approved via addenda, which will be issued to all bidder’s.
   6. In order to include an approved Substitution/or Equal in the bid, the bidder must acknowledge on the bidders bid form that the bidder intends to provide the approved Substitution/or Equal and the bidder shall also list the name of the approved Substitution/or Equal manufacturer

as well on the bidders bid form. Failure of the bidder to express their intent to use the approved Substitution/or Equal as part of the bid will exclude the bidder from being able to utilize another Manufacturer from the one specified.

7. If a bidder uses a Substitution/or Equal, the bidder will take responsibility to pay for the re-engineering and coordination of all other items that are to be provided that have been defined in the Contract Documents as additional items to the roofing system, including but not limited to all deck preparation/modifications, additional flashings or modification to existing roof drains.

1.05 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review the use and staging of hoisting equipment required for the project including safety , OSHA regulations pertaining to operation and use of this equipment.
5. Review Contractor's (and their Subcontractor's) responsibility to comply with OSHA regulations, requirements for provision and implementation of safety equipment and regulations. Additionally, Contractor shall keep on-site at all times a minimum of three complete additional safety units (i.e.: harnesses, rigging gear, hardhats, safety vests, etc.) for use by site visitors requiring access to the work.
6. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
7. Review structural loading limitations of roof deck during and after roofing.
8. Review the location of any fresh-air intakes for the building with the building owner which may have to be covered or re-directed to maintain intakes during roofing operations.
9. Review base flashings, special roofing details, roof drainage, roof penetrations; raising and/or replacement of equipment curbs, disconnection and re-connection of mechanical roof mounted equipment; and condition of other construction that affects roofing system.
10. Review governing regulations and requirements for insurance and certificates if applicable.
11. Review temporary protection requirements including but not limited to safety lines, roof barriers, walkway protections as required by OSHA during and after roofing installations.
12. Review roof installation observations during construction; notifications and repair procedures after roofing installation with the manufacturer's field representative.

1.06 ACTION SUBMITTALS

A. Submittals shall be made in accordance with Section 013300 - {\t\#1000041}.

B. Product Data: For each type of product.

C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations including laps, seam layout, direction of laps and flashing details.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of roofing and fastening spacing and patterns for mechanically fastened roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

D. Samples for Verification: For the following products:

1. Membrane roofing, of color required, 12 inch x 12 inch.
2. Insulation Board - 12" x 12" sample.
3. Cover Board - 12 inch x 12 inch.
4. Walkway pads or rolls, of color required.

E. Manufacturers complete installation Instructions.

F. SDS Sheets for all materials.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of complying with performance requirements.

C. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.

D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

E. Sample Warranties: For manufacturer's special warranties.

1.08 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.09 QUALITY ASSURANCE

A. Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.

B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by membrane manufacturer for specified roofing system and specified membrane manufacturer's warranty and shall be in compliance with specified regulatory requirements.

C. Qualifications.

1. Manufacturer: Company specializing in manufacturing the products specified in this section with ten (10) years documented experience.
2. Applicator: Company specializing in performing the work of this section with five (5) years documented experience. Installer shall be a qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
2. All curable materials must be stored between 60° F and 80°F.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

E. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.11 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.12 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, and other components of roofing system.
2. Warranty Period: 30 years from date of Substantial Completion with no dollar limitation (NDL) on the cost or quantity of repairs. Pro-rated roofing warranties will not be accepted.
3. The warranty shall include coverage for wind speed with peak gusts of 120 mph measured at 30 feet above ground level. Certification is required with bid submittal indicating the manufacturer has reviewed and agreed to such wind coverage.
4. Warranty shall also provide coverage for roof leakage caused by hail up to and including 2 inch in diameter. An additional 1 inch shall be provided for roofs installed with the flexible FAST system.
5. Materials and Workmanship for the following items shall be included in the manufacturer's warranty:
    a. Membranes.
    b. Flashings, including metal flashings and accessories supplied by roofing membrane manufacturer.
    c. Insulation.

d. Fasteners and adhesives.
e. Accessories.
f. Roof drains.
g. Roof Edge and coping systems.

6. The warranty deliverables shall include the following:
   a. Original of the warranty with original signature of a roofing manufacturer's company official authorized to sign the warranty.
   b. An additional three copies of the signed warranty noted above.
   c. Record set of as-built roofing drawings.
   d. Final Roof Inspection Report by the manufacturer's authorized Field Representative.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain components including roof insulation for roofing system from manufacturer approved by membrane roofing manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
   1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G154, or ASTM G155.
   2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:
   1. Field of Roof Uplift Pressure: -35.86 lbf/sq. ft.
   2. Perimeter Uplift Pressure: -62.54 lbf/sq. ft. .
   3. Corner Uplift Pressure: -83.7 lbf/sq. ft..

D. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low -slope roof products.

E. Energy Performance: Roofing system shall have an initial solar reflectance index of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

F. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.03 EPDM ROOFING

A. EPDM: ASTM D4637/D4637M, Type II, scrim or fabric internally reinforced, uniform, flexible EPDM sheet.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Carlisle SynTec Incorporated.
      b. Johns Manville.
      c. Versico Incorporated.
   3. Thickness: 90 mils, nominal.
   4. Exposed Face Color: Black or White on black as selected by the Architect.

B. Fleece-Backed EPDM: ASTM D4637/D4637M, Type III, non-reinforced, uniform, flexible EPDM sheet, laminated to a nonwoven polyester fabric backing except at selvages. Sheets shall be ten foot wide in maximum lengths provided by the manufacturer.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Carlisle SynTec Incorporated.
      b. Versico Incorporated
   2. Membrane thickness: 60 mils.
   3. Fleece Backing: Non-woven Polyester, 55 mils thick.
   4. Exposed Face Color: Black.

2.04 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
   1. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content:
      a. Plastic Foam Adhesives: 50 g/L.
      b. Gypsum Board and Panel Adhesives: 50 g/L.
      c. Multipurpose Construction Adhesives: 70 g/L.
      d. Fiberglass Adhesives: 80 g/L.
      e. Single-Ply Roof Membrane Adhesives: 250 g/L.
      f. Single-Ply Roof Membrane Sealants: 450 g/L.
      g. Non-membrane Roof Sealants: 300 g/L.
      h. Sealant Primers for Nonporous Substrates: 250 g/L.
      i. Sealant Primers for Porous Substrates: 775 g/L.
      j. Other Adhesives and Sealants: 250 g/L.

B. Protection Sheet: Epichlorohydrin or neoprene non reinforced flexible sheet, 55 to 60-mil thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.

C. Bonding Adhesive, splice cleaners, splice cement and splice tape: Manufacturer's standard.

D. Prefabricated Control or Expansion Joint Flashing: Type approved for the total roof system by roofing manufacturer.

E. Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer's flexible FAST spray-applied using the Rig Splatter application, low-rise, two-component urethane adhesive formulated for compatibility and use with fleece-backed membrane roofing.

F. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 6 inch wide minimum, butyl splice tape with release film.

G. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.

H. Molded Pipe Flashings inside and outside corner flashing: as recommended by membrane manufacturer.

I. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

J. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

K. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

1. Provide white flashing accessories for white EPDM membrane roofing.

L. Walkway Pads: Protective surfacing for roof traffic shall be non-slip textured, pressure-sensitive walkway pads (with Factory-Applied Tape on the underside of the walkway) adhered to the membrane surface in conjunction with primer. Color to match roofing.

M. Roof edge system materials: SecurEdge 3000 snap-on Roof Edge system, stainless steel anchor clips, 0.050 inch thick aluminum fascia / edge cover. Fascia Cover shall be included in roof system warranty. Roof Edge Kynar finish shall be as selected by Architect. Provide complete system with concealed cover plate, extenders, Factory-fabricated corners, end caps, integral Downspout Scuppers and extend fascia boxes, Conductor Heads, Copings, and fasteners.

N. Cantilever Coping: Metal Era, Perma-Tite Gold Cantilever Coping with 12" wide anchor clips with 16 gauge base and 20 gauge galvanized risers spaced at 3'-0" on center, 8 inch wide concealed splice plate and butyl strips at each joint. Joints spaced evenly in longest lengths possible up to 12 feet with factory welded prefabricated corner units. Outside and insides face dimensions shall be as indicated on the drawings with a 6 inch manufacturer maximum dimension. Coping material shall be 0.063 inch Aluminum. Provide Pre-welded Inside Miters, Outside Miters, Endwall Flashing (Right and Left), Endcaps (Right and Left), and "T' Miters and others as required by drawing configurations. Provide Kynar finish in color as selected by the Architect from the manufacturer's full color range.

2.05 VAPOR RETARDER

A. Self-Adhering-Sheet Vapor Retarder: ASTM D1970/D1970M, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

2.06 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by EPDM roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1 (GRF), Grade 3 (25 psi), felt or glass-fiber mat facer on both major surfaces.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Atlas Roofing Corporation: ACFoam-II
      b. Carlisle Syntec Systems: InsulBase POLYISO insulation.
      c. Hunter Panels: H-Shield
      d. R-Value per Inch: 5.7

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to minimum slope of 1/4 inch per 12 inches (1:48) for new roof installations (unless otherwise indicated for re-roofing projects). Minimum LTTR-30, 4' x 4' board size.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated or at least twice the slope of the tapered insulation in the field of the roof areas.

2.07 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.
   1. R Value per inch: 5.7

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
   1. Modified asphaltic, asbestos-free, cold-applied adhesive.
   2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
   3. Full-spread spray-applied, low-rise, two-component urethane adhesive.

D. Cover Board: ASTM C1278/C1278M, cellulosic-fiber reinforced, water-resistant gypsum substrate, 5/8 inch thick.
   1. Products: Subject to compliance with requirements, provide the following:
      a. USG Corporation; Securock Gypsum-Fiber Roof Board.

E. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
   1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
   2. Verify that perimeter wood blocking, curbs, and nailers are securely anchored to roof deck at roof perimeters, penetrations and terminations in accordance with Factory Mutual 1-49 requirements and that nailers match thicknesses of insulation .
   3. Steel Decks: Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 - {\t\#1000068}, as applicable.
   4. Concrete Decks:
      a. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
      b. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
      c. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.

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

3.02 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.03 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.04 SUBSTRATE BOARD INSTALLATION

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
   1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.05 VAPOR-RETARDER INSTALLATION

A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches and 6 inches, respectively. Seal laps by rolling.

B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.06 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
   1. Where installing composite and non-composite insulation in two or more layers, install non-composite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
   1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
   2. Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
   3. Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.
   1. Fasten cover boards according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
   2. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.07 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere fabric-backed roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow membrane to relax before installing.

B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.

E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeters.

F. Apply roofing with side laps shingled with slope of roof deck where possible.

G. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.

H. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

I. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal membrane roofing in place with clamping ring.

J. Adhere protection sheet over membrane roofing at locations indicated.

3.08 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.09 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.

B. Manufacturer's Field Services: The manufacturer's authorized Field Representative and Roofing Quality Control Inspector shall provide the following:

1. Attend and conduct Pre-installation Meeting.
2. Perform preparatory, initial, follow-up and final inspections for roof insulation and roofing system.
3. Prepare and submit inspection reports for each inspection made.

C. Upon completion of the installation the manufacture's authorized Field Representative shall conduct an on-site inspection in the presence of the Architect/Engineer to insure that the installation has been installed in accordance with the manufacturer’s specifications.

D. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.
2. Flood each area for 24 hours.
3. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.

E. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

F. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

G. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Copings and splice plates.
   2. Drip edges.
   3. Base and Counter flashing.

1.03 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.04 REFERENCES:

A. ASTM B32 - Standard Specification for Solder Metal; 2020.

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2022.

C. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.05 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 manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.
   1. Detail fabrication and installation layouts, details. Distinguish between shop- and field-assembled work.
   2. Include identification of material, thickness, weight, and finish for each item and location in Project.
   3. Include details for forming, including profiles, shapes, seams, and dimensions.
   4. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
   5. Include details of termination points and assemblies.
   6. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
   7. Include details of roof-penetration flashing.
   8. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
   9. Include details of special conditions.

10. Include details of through wall scuppers including section details, dimensions of scupper openings and height above finished roof surface, edge sealing details, interface and sealing with roof membrane system, counterflashing and exposed exterior fascia conditions.
11. Include details of connections to adjoining work.

C. Samples for Verification: For each type of exposed finish.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of coping, scupper, roof edge and flashing required to complete the roofing system. All sheet metal shall be SPRI ES-1 tested and FM approved for this project.

C. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.07 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. For copings and roof edge flashings that are SPRI ES-1 tested and FM Approvals approved, shop shall be listed as able to fabricate required details as tested and approved.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

D. Perform work in accordance with SMACNA (ASMM), CDA A4050, and approved manufacturers requirements and standard details, except as otherwise indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.09 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

B. Metal Copings, Gravel Stops, scuppers, roof edges, counterflashing, and other components incorporated or in contact with the Roofing System shall be pre-approved by and made integral to the 20-year Total Roofing System warranty specified in Division 07. Shop drawings and components shall be reviewed and approved by the Roofing manufacturer prior to submittal to the architect for approval. Submit a letter signed by a current representative of the manufacturer on Roofing manufacturer letterhead, attesting to this approval and warranty acceptability. Submit this certification letter as part of the Shop Drawing submittals for this section.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated or required by the approved roofing manufacturer responsible for providing the Total System Warranty for the roof system.

C. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. FM Approvals Listing: Manufacture and install copings, roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-120 Identify materials with name of fabricator and design approved by FM Approvals.

E. SPRI Wind Design Standard: Manufacture and install Metal Copings, Gravel Stops, Scuppers, Roof edges, Counterflashing, and other components of roof metal work tested according to SPRI ES-1 and capable of resisting the required design pressure.

F. Recycled Content of Copper-Sheet Flashing and Trim: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 40 percent.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations 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

2.02 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper, natural finish, 16 oz. / s.f. (24 gage) minimum or as indicated on the drawings.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Hussey Copper Ltd
      b. Revere Copper Products, Inc
      c. Or approved equal.
   2. Non-patinated Exposed Finish: Mill.

C. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
   1. Thickness: 0.040 inch, 0.050 inch, or 0.063 inch as indicated on the drawings.
   2. Exposed Coil-Coated Finish:
      a. Two-Coat 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.
   3. Color: As selected by the Architect from the manufacturer's full range of color offerings.
   4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.03 UNDERLAYMENT MATERIALS

A. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; non-perforated.

B. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
   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. Grace Construction Products, a unit of W. R. Grace & Co.-Conn; Grace Ice and Water Shield HT.
      b. Henry Company; Blueskin PE200 HT.
   2. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 deg F or higher.
   3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F or lower.

C. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.04 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
      b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
   2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C920, elastomeric polyurethane silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

2.05 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
   1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   2. Obtain field measurements for accurate fit before shop fabrication.
   3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
   4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, non-corrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams: Fabricate non-moving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

2.06 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following material(s):
   1. Aluminum: 0.040 inch thick. Finish color as selected by the Architect.

B. Drip Edges: Fabricate from the following materials:
   1. Aluminum: 0.040 inch thick. Finish color as selected by the Architect.

C. Eave, Rake Flashing: Fabricate from the following materials:
   1. Aluminum: 0.040 inch thick. Finish color as selected by the Architect.

D. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
   1. Aluminum: 0.040 inch thick. Finish color as selected by the Architect.

E. Flashing Receivers: Fabricate from the following materials:
   1. Aluminum: 0.032 inch thick. Finish color as selected by the Architect.

F. Roof-Penetration Flashing: Fabricate from the following materials:
   1. Aluminum: 0.050 inch thick. Finish color as selected by the Architect.

2.07 WALL SHEET METAL FABRICATIONS

A. Opening Flashings: Fabricate head, sill, jamb, and similar flashings to extend 6 inches beyond wall openings. Form head and sill flashing with 2-inch (50-mm-) high, end dams. Fabricate from the following materials:
   1. Aluminum: 0.032 inch thick. Finish color as selected by the Architect

2.08 MISCELLANEOUS FLASHINGS - COORDINATED SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:
   1. Aluminum Sheet: 0.040 inch thick. Finish color as selected by the Architect.

B. Overhead-Piping Safety Pans: Required where plumbing, sprinkler and/or heating piping containing liquid pass over or near electrical panels, electrical switches or other water sensitive equipment. Fabricate from the following materials:
   1. Stainless Steel: 0.018 inch thick (26 gauge) thick.
   2. Pans shall be a minimum of 1-1/2" deep.
   3. Provide minimum one inch drain line for each four square feet of pan area. Pipe to nearest floor drain or as directed by the Architect.
   4. Pans and drain fittings shall be watertight.
   5. Suspend pans from structure above via chains or all thread and unistrut.

2.09 GENERAL FINISH REQUIREMENTS

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: 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

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

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

3.02 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

B. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

3.03 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.

5. Torch cutting of sheet metal flashing and trim is not permitted.
6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

E. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section {\id\#1000279} - {\t\#1000279}.

3.04 ROOF-DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter spacers to front and back of gutter.
2. Anchor and loosely lock back edge of gutter to continuous eave or apron flashing.
3. Anchor gutter with gutter brackets spaced not more than 30 inches apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.
4. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.
5. Install continuous gutter screens on gutters with noncorrosive fasteners, hinged to swing open for cleaning gutters.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints.

1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches on center.
2. Connect downspouts to underground drainage system.

3.05 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.06 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 04.

C. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 6 inches beyond wall openings.

3.07 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

B. Overhead-Piping Safety Pans: Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Contract

Drawings. Slightly pitch pans towards pan drain location. Pipe and install drain line to plumbing waste or drainage system.

3.08 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.09 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
B. Soldering operations: Clean and neutralize flux materials. Clean off excess solder.
C. Clean off excess sealants.
D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. Upon completion of sheet metal flashing and trim installations, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Manufactured Roof Edges Fascias <>.
   2. Manufactured Expansion Joint Covers.
   3. Lightning Rod Brackets.
   4. Accessories.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2020, with Errata (2022).

B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2017.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

D. FM (AG) - FM Approval Guide; current edition.
   1. FM 1-49 - Perimeter Flashing.

E. Miami-Dade County, Florida.

1.04 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Single Ply Roofing Industry (SPRI) Wind Design Standard: Manufacture and install copings tested according to SPRI ES-1 and capable of resisting the following design pressures:
   1. Design Pressure: As indicated on Drawings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.05 ACTION SUBMITTALS

A. See Section 013300 - {\t\#1000041}.

B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:

1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
3. Details of termination points and assemblies, including fixed points.
4. Details of special conditions.

D. Samples for Verification: For copings made from 12-inch lengths of full-size components including fasteners, cover joints, accessories, and attachments.

E. Color Samples for Initial Selection Purposes: Submit manufacturer's color samples of materials, consisting of complete color chart representing manufacturer's full range of available colors.

1.06 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for materials specified in this section. Submit evidence of compliance with ANSI/SPRI/FM 4435/ES-1 meeting the wind speed and pressures required in this section and in accordance with the AHJ and the governing Building Code.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum fifteen (15) years documented experience.

C. Installer Qualifications: Company specializing in the installation of products specified in this section with minimum five (5) years documented experience.

D. Warranty Documentation: Submit sample warranties covering workmanship, wind speed and finishes.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

1.09 WARRANTY

A. Provide a fully executed manufacturer's warranty as specified for the roof edge system, when installed per manufacturer's instructions. Product Warranty Period:

1. Wind, 215 mph: Lifetime.

2. Five-year workmanship warranty covering replacement or repair of products that are defective in material or workmanship.

B. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 EXPOSED METALS

A. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

1. Surface: Smooth, flat finish.
2. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   a. Three-Coat Fluoropolymer: AAMA 2605. System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent PVDF resin by weight.
   b. Concealed Surface: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.02 CONCEALED METALS

A. Aluminum Sheet: ASTM B209, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

1. Material: 0.063 inch aluminum

2.03 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 deg F.
2. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F.
3. Products: Subject to compliance with requirements, provide one of the following:
   a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
   b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
   c. Henry Company; Blueskin PE200 HT.

2.04 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated by the manufacturer:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
3. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
5. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F 2329.

C. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

E. Butyl Strip: 1/8 inch thick by 3/4 inch wide Butyl Tape Factory-applied to sub-fascia to provide water cut-off capabilities and enhance wind up-lift capabilities of the fascia system in high wind areas. Compatible with Single Ply EPDM and TPO roofing systems.

2.05 ROOF EDGE FASCIAS AND EXTENDERS

A. Roof Edge Fascias and Extenders: Manufactured Edge fascias and Extender metal fabrications consisting of formed-metal factory fabricated in lengths not exceeding 12 feet, concealed anchorage and subfascias with factory applied Butyl Strip; splice plates at joints, inside and outside corner units, and finished end cap units.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Metal-Era, Inc.: Anchor-Tite HG Extended and Fascia Extenders with offset (Basis of Design). Tel.: 1-800-558-2162
   b. MM Systems Corporation.
   c. Hickman Company, W. P.
   d. Merchant & Evans, Inc
   e. Perimeter Systems; a division of Southern Aluminum Finishing Company, Inc.
   f. Petersen Aluminum Corporation.
2. Fascia, Extender, and Miter Cover Material: aluminum, 0.050 inch aluminum inch thick.
   a. Finish: Three-coat fluoropolymer.
   b. Color: As selected by Architect from manufacturer's full color range.
   c. Configuration: Straight
3. Inside and Outside Corners, Transition Miters: Factory mitered and continuously welded.
4. Concealed Splice Plates: Aluminum in gauge and finish to match Roof Edge Fascia metal.
5. Endcaps and Endwall Flashings, Pilaster Caps: Factory Fabricated to match coping finish and profiles, welded where possible.

6. Continuous Cleats: 20 gauge galvanized steel.
7. Attachment Method: Snap-on.
8. Anchor Bar: 12 foot long extruded aluminum with EPDM Splice Plates and slotted fastener holes spaced 12 inches on center.
9. Edge Fascia Height: 10 inches.
10. Extender Height: As indicated on the drawings.
    a. Type: Offset with continuous edge cleat.
    b. Material: Gauge or Thickness and Material to match Roof Edge Fascia.
    c. Finish: To match selected Roof Edge Fascia.
    d. Joints: Lap sections one inch at ends at notch provided by factory. Field trim as needed at cut field cut sections to provide a smooth lap.
11. FM Approved Ratings:
    a. Perimeter rating: 1-150.
    b. Corner Rating: 1-225

2.06 ROOF EXPANSION JOINTS

A. Roof to Wall Expansion Joints: Perma-Tite Expansion Joints as manufactured by Metal Era Inc. or Architect Approved equivalent. Tel.: 1-800-558-2162.

1. Cover Material: aluminum, 0.050 inch aluminum inch thick. Width as indicated on the drawings with 1 inch (minimum) expansion overhang. Form cover with sealant receiver at top edge. Install with sealant as per manufacturer's instructions.
    a. Finish: Three-coat fluoropolymer, Kynar 500, AAMA 2605.
    b. Color: As selected by Architect from manufacturer's full color range.
    c. Length: 12 linear feet per section or as indicated on the drawings.
    d. Inside and Outside Miters, Endcaps, Endwall Flashings and Accessories: Factory welded.
    e. Splices: 12 inch wide Concealed Splice Plates with Factory-applied dual non-curing sealant strips.
    f. Anchor Clips: 8 inch wide 20 gauge galvanized steel cleats spaced 36 inches on center.
    g. Top Rail at curb: Continuous 24 gauge galvanized steel. Factory supplied 1- 1/4 inch galvanized Ring-Shank nails secured at 24 inch spacing.
    h. Continuous Cleats (Wall and Curb): 20 gauge galvanized steel with Factory supplied #10 by 1-1/2 inch stainless steel screws with shouldered washer spaced 18 inches on center into factory slotted openings. Form with sealant receiver at wall. Install with tape and sealant as per manufacture's instructions.
    i. Expansion Joint Cover Face Depth: As indicated on the drawings.
    j. Wind Warranty: Twenty (20) Years, 120 mph.
    k. Finish Warranty: Thirty (30) Years.

2.07 ROOF SCUPPERS

A. Spillout Scupper: Anchor-Tite extended fascia scupper Spillout Scupper Type SSA (tapered) factory welded with 4” projection. Manufacturer: Metal-Era or Architect approved equivalent.

1. Construction:
    a. Factory welded construction, 0.050 inch aluminum, provide as indicated on the drawings.
2. Finish:

a. Color: Kynar 500 PVDF, AAMA 2605 as selected by the Architect from the manufacturer's full color chart.
b. Warranty: Kynar 500 PVDF thirty (30) year finish warranty.

2.08 LIGHTING ROD BRACKET

A. Style 1 Lighting Rod Bracket as manufactured by Metal Era Inc.
1. 20 gauge stainless steel material.
2. Material Width: 12 inches.
3. Spacing: As indicated on the drawings.
4. Configuration: As indicated on the drawings.

2.09 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted 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.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.03 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture. Tie into specified roofing system in accordance with the approved roofing manufacturer's specifications and instructions to support issuance of the Total System Roofing Warranty inclusive of edge metals specified herein.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating or install a compatible separator membrane where in contact with wood, ferrous metal, or cementitious construction.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints with sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.04 INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with compatible concealed fasteners.

B. Anchor Roof Edges and Fascias to meet performance requirements.

1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at 30-inch centers maximum or manufacturer's and FM required spacing to comply with performance requirements.

3.05 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pre-finished aluminum gutters, downspouts, and accessories
B. Precast concrete splash pads.

1.02 REFERENCES

A. ANSI/SPRI GT-1 - Test Standard for Gutter Systems.
B. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.
C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
D. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
E. ASTM B32 - Standard Specification for Solder Metal; 2020.
F. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
G. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2024).
H. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 SUBMITTALS

A. Submit under provisions of Section 013300 - SUBMITTALS.
B. Product Data: Provide data on prefabricated components.
C. Shop Drawings: Indicate locations, configurations, jointing methods, finishes, fastening methods, accessories, locations and installation details.
D. Manufacturer’s Certification: Submit manufacturer’s certification that materials comply with specified requirements and are suitable for intended application.
E. Manufacturer’s Project References: Submit manufacturer’s list of 10 successfully completed gutter projects of similar size and scope to this Project, including project name and location, name of architect, and type and quantity of gutters furnished.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code(s) for size and method of rain water discharge.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section .016500 - PRODUCT DELIVERY, STORAGE AND HANDLING
B. Stack preformed and prefinished material to prevent twisting, bending or abrasion, and to provide ventilation. Slope to drain.

C. Prevent contact with materials during storage which may cause discoloration, staining or damage.

1.06 COORDINATION

A. Coordinate work under provisions of Section 013100 - PROJECT MANAGEMENT AND COORDINATION.

1.07 WARRANTY

A. Warranty Period, Wind: Gutters shall not blow off for 30 years in wind speeds up to 160 mph, when installed in accordance with manufacturer's instructions.

B. Warranty Period, Finish: Limited 30-year warranty for prefinished coil-coated steel and aluminum coated with Kynar 500 standard colors covering fade, chalk, and film integrity.

C. Warranty Period, Product: 5-year workmanship warranty covering replacement or repair of products that are defective in material or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Manufacturer: Metal-Era, 1600 Airport Road, Waukesha, WI 53188. Phone 800-558-2162 www.metalera.com. info@metalera.com.

B. Architect approved equivalent.

C. Substitutions: See Section 016100 - Basic Product Requirements and Section 012500 - Substitution Procedures

D. Single Source: Provide materials from single manufacturer.

2.02 PRODUCTS

A. Gutters:

1. Seal-Tite Gutter System:
   a. Model: WR
   b. Profile: Box
   c. Sizes: 5.25 inches
   d. Gutter metal gauge:
      1) 0.050" aluminum thick.
      2) Finish: Kynar 500, color to match roof edge fascia, coping, and drip edge metals.
      3) Color: As selected by the Architect from the manufacturer's full color offering.
   e. Approvals: FM 1-90 rating and ANSI/SPRI GT-1 compliant.
   f. Accessories:
      1) Corners, end caps, internal concealed joint splices, 2 piece extruded internal gutter brackets, and expansion joints shall be fabricated by manufacturer. Factory fabricated; mitered corners shall have 17-1/2" nominal leg lengths.
      2) Provide matching ledge caps, downspouts, or other special fabrications as detailed.
   g. Gutter Fabrication:
      1) Form gutters of profiles and sizes indicated in accordance with approved shop drawings.

2) Fabricate in accordance with the FABRICATION Article below.

2. Architect Approved equivalent.

B. Downspouts:

1. Seal-Tite Downspouts:
   a. Model: Industrial Downspout - Closed Face.
   b. Configuration: Rectangular
   c. Sizes: As indicated on the drawings.
   d. Downspout metal gauge:
      1) 0.050” aluminum thick.
      2) Finish: Kynar 500, color to match roof edge fascia, coping, and drip edge metals.
      3) Color: As selected by the Architect from the manufacturer's full color offering.
   e. Fabrication:
      1) Provide downspouts as indicated on the approved shop drawings in the same metal, gauge and finish as gutter.
      2) Downspout supports: Flat 1-1/4” minimum width straps matching leader profile and color.
         (a) Provide downspout support connections at 5’ – 0” maximum on center with a minimum of at least two connections per section.
      3) Downspout Elbows: Fabricate to downspout profile with factory soldered connections.
      4) Fasteners: Aluminum, finish exposed fasteners same as leader metal.
         (a) Provide continuous transitions from downspouts to underground piping where indicated on the drawings.
      5) Fabricate in accordance with the FABRICATION Article below.
2. Architect Approved equivalent.

2.03 MATERIALS

A. Aluminum: ASTM B209/B209M, 3003 alloy, H14 temper; 0.050 inch thickness or as indicated; mill finish interior, shop pre-coated Kynar 500 or Hylar 5000 finish, color to match existing structure. or as selected by the Architect from the manufacturer's full color offering.

B. Pre-Finished Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal.
   1. Finish: Shop pre-coated with modified silicone coating.
   2. Color: As selected from manufacturer's standard colors

C. Stainless Steel: ASTM A666/A666M, Type 304, soft temper, 0.015 inch (0.4 mm) thick; smooth No. 4 finish.

D. Polyvinyl Chloride (PVC): ASTM D2665, virgin vinyl, SDR 35 pipe and fittings, high impact type, colorfast; PVC compatible paint to match downspout color.

2.04 ACCESSORIES

A. Anchorage Devices: Concealed Type recommended by manufacturer.

B. Gutter Supports: Hidden flanges screwed to fascia and interlocked / fastened to the top front edge of gutter.

C. Downspout Supports: Flat 1 1/4" min. width concealed straps matching leader profile, gauge, finish, and color.

D. End Caps, Elbows: Fabricate to match gutter profile, material, and finish with factory soldered connections prior to finish application.

E. Fasteners: Aluminum finish exposed fasteners same as leader metal.

F. Leaf Screens: Compatible metal or stainless micro mesh screen with edge frames, sized to fit and cover entire width of gutter in lengths recommended by the manufacturer. Provide matching hinged frames to allow gutter access as per manufacturer.

1. Color: As selected by the Architect from the manufacturer's full color offering.
2. Warranty: Twenty-five Year warranty covering against defects in materials and/or workmanship.
3. Manufacturer: Valor Gutter Guard or Architect Approved equivalent.

G. Splash Blocks: Provide precast concrete type of size and profile indicated on the drawings where downspouts discharge onto grade; minimum 5,000 psi at 28 days with minimum 5 percent air entrainment.

H. Downspout Boots: Provide Cast Iron Downspout Boots, ASTM A48/A48M with top bell sized for downspout. See drawings for Boot height required and tie-in connection to site drainage piping system.

I. Primer: Zinc chromate type.

J. Protective Backing Paint to provide electrolytic separation:

1. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.05 FABRICATION

A. Form gutters and downspouts of profiles and sizes indicated in accordance with approved shop drawings.

B. Fabricate with required connection, expansion and splice pieces.

C. Form sections in required profile, true and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints and at intervals required by the manufacturer.

D. Hem exposed edges of metal.

E. Solder shop formed metal joints. After soldering, remove flux. Wipe and wash solder joints clean. Weather seal all field joints and intersections with adjacent materials with color matching exterior vertical grade sealant.

F. Fabricate gutters and downspouts with accessories, supports, and connections for a complete system; seal watertight.

2.06 FINISHES

A. Apply bituminous protective backing on surfaces in contact with dissimilar materials.

B. Finish Downspout Boots with compatible exterior Finish Paint in color as selected by the Architect. See Section {\id\#1000901} - {\t\#1000901}.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

3.02 INSTALLATION

A. Install gutters, downspouts and accessories in accordance with manufacturer's instructions and approved shop drawings.
B. Slope gutters 1/8 inch per foot minimum to leader locations.
C. Seal metal joints other than factory welded joints watertight.
D. Provide leader strap connections at 60 inch spacing on center maximum with a minimum of at least two connections per section.
E. All gutter hangers shall be installed and fastened at 30 inches on center maximum.
F. Provide connection of Downspout Boots to Site drainage piping. See drawings for additional information.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Roof curbs.
2. Equipment supports.
3. Pipe supports.
4. Preformed flashing sleeves.
5. Retrofit Roof Drains.
6. Standing Seam Mounted Railing Systems.
7. Standing Seam mounted Walkway Systems.

1.03 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.04 ACTION SUBMITTALS

A. See Section 013300 - {\t\#1000041}, for Submittal Procedures.

B. LEED Data Submissions: See Section 018113 - {\t\#1000135}.

C. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

D. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

B. Warranty: Sample of special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.07 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.08 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 METAL MATERIALS

A. Aluminum Sheet: ASTM B209, 0.063 inch thickness or as indicated, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Mill Finish: As manufactured.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
3. Baked-Enamel Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
4. Kynar 70% PVDF Premium Coastal, Two-coat Fluoropolymer coating with primer to maintain Warranty within 1500 feet of the coastline, AAMA 2605.
5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Stainless-Steel Sheet and Shapes: ASTM A240/A240M or ASTM A666/A666M, Type 304.

C. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.

2.02 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C1289, thickness as indicated.

C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

D. Underlayment:

1. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt, non-perforated.
2. Polyethylene Sheet: 6-mil thick polyethylene sheet complying with ASTM D4397.
3. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

E. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F 2329.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
4. Fasteners for Stainless-Steel Sheet: Series 316 stainless steel.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

G. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

H. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

I. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.03 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Thybar Corporation
   b. Greenheck Fan Corporation

c. Pate Company (The)

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Material: Aluminum sheet, 0.090 inch thick airtight and watertight welded corners.

1. Insulation: 1 1/2 inch thick, 3 lb density rigid insulation.
2. Height: 12 inch minimum above deck or as indicated.
3. Curb Type: TC-3 (No Cant)

D. Construction:

1. Liner: Same material as curb, of manufacturer's standard thickness and finish.
2. Fabricate curbs to minimum height of 12 inches above roof elevation unless otherwise indicated.
3. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange. Contractor to field verify roof conditions prior to ordering curb.

2.04 EQUIPMENT SUPPORTS

A. Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Thybar Corporation
   b. Greenheck Fan Corporation
   c. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc
   d. Pate Company (The)

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported. Curb shall span a minimum of two structural supports and shall cantilever a maximum of 12 inches where necessary.

C. Loads: Coordinate and verify load requirements with approved manufacturer's Product Data for each piece of equipment requiring support.

D. Material: Aluminum sheet, 0.090 inch thick, airtight and watertight welded corners . Internally reinforced with bulkheads at 24 inches on center, 2 inch x 4 inch wood nailer with 18 gauge flashing cover.

1. Insulation: 1 1/2 inch thick, 3 lb density rigid insulation.
2. Height: 12 inch minimum above deck or as indicated.
3. Curb Type: TEMS-3 (No Cant) for Single Ply Roofing and TEMS-1 (Cant with Shoulder) for SBS Roofing systems.

E. Construction:

1. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
2. Fabricate equipment supports to minimum height of 12 inches unless otherwise indicated.

3. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.
4. Security Grille: Provide where indicated.

2.05 AUTOMATIC SMOKE VENT

A. Automatic Smoke Vents: Thermolatch® positive hold/release mechanism ensures reliable vent operation when a fire occurs. Automatically releases vent covers upon the melting of a UL-listed 165°F (74°C) fusible link. The curb-mounted fusible link housing allows the latch to be quickly and easily reset from the roof level. Fully insulated and gasketed for weather-tightness. Constructed with corrosion resistant materials
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Bilco Company (The), www.BILCO.com
      b. Acudor Products, Inc.
      c. Babcock-Davis
      d. Nystrom

B. Model (Size): S-50SV

C. Type: Single-leaf lid, Thermally Broken.

D. Loads: Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m2) with a maximum deflection of 1/150th of the span or 90 psf (438kg/m2) wind uplift.

E. Hatch Material: Aluminum sheet, 11 gauge, 0.090 inch (2.3 mm) thick.
   1. Finish: Mill Finish (Aluminum) with powdercoat finish.
   2. Color: As selected by Architect from manufacturer's full range.

F. Construction:
   1. Curb and Cover Insulation: Polyisocyanurate insulation board, 1" thick with an R-value of 6 (U=0.167) with an 18 gauge aluminum liner.
   2. Cover: Thermally broken, insulated (1 inch concealed fiberglass insulation), and double walled, with 11 gauge aluminum liner of same finish as outer metal lid. Cover with 3 inch beaded overlapping flange shall have a heavy extruded EPDM rubber gasket bonded to the cover interior providing a continuous seal with the top of the curb. Cover internally reinforced for 40 psf live load. For Type GSV units: Covers shall have a polycarbonate dome framed with rigid extruded aluminum and coated for UV resistance.
   3. Curb Liner: Manufacturer's standard, 12 inches high of same material and finish as metal curb. The curb shall be formed with a 3 1/2 inch flange with 7/16 inch holes provided for securing to the roof deck. The curb shall be equipped with an integral 11 gauge aluminum cap flashing with fully welded corners and stamped tab clip flashing system spaced 6 inches on center for securing roof membrane. Bil-Clip Flashing System.
   4. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile. Coordinate with Metal Roofing Supplier and Hatch location(s) accordingly.
   5. Fabricate 11 gauge aluminum curbs with thermally broken interior and exterior surfaces to a minimum height of 12 inches unless otherwise indicated.
   6. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

7. Operation: Compression springs enclosed in telescopic tubes open covers automatically against a 10 psf (49 kg/m2) snow/wind load when released. Automatic hold-open arms lock the cover in the full open position. Cover is supplied with a shock absorber to assure a controlled rate of opening. Gas springs have integral dampers to assure a controlled rate of cover opening and have a cyclic durability of 50,000 cycles.
8. Latch: Positive hold/release mechanism controlled by a single UL-listed 165°F (74°C) fusible link. Designed to hold the cover closed against a 90 psf (438 kg/m2) uplift force. Provided with interior and exterior pull release cables to manually open vent cover. Thermolatch option: 24 VDC Thermolatch (1.8 amps).
9. Performance Rating: UL-listed. Complies with UL 793 and UL 790, Class A (burning brand test).

G. Hardware: Heavy stainless-steel spring latch with interior and exterior turn handles, pintle-type hinge system, Type 316 stainless steel hinge pins, and interior and exterior padlock hasps.

1. The latch strike(s) shall be a stamped component bolted to the curb assembly.
2. Provide two-point latch on lids larger than 84 inches.
3. The cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1 inch diameter red vinyl grip handle to permit the easy release for closing.
4. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be Type 316 stainless steel.
5. Cover hardware shall be bolted into the heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.
6. Manual pull release cables: Interior and exterior cables with red vinyl grips shall be provided and allow the unit to be opened without disturbing the fusible link.

H. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

1. Height: 42 inches above finished roof deck.
2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
6. Post and Rail tops and ends: Weather resistant, closed or plugged with prefabricated end fittings.
7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
8. Fabricate joints exposed to weather to be watertight.
9. Fasteners: Manufacturer's standard, finished to match railing system.
10. Finish: Manufacturer's standard.
    a. Color: As selected by Architect from manufacturer's full range.

I. Ladder-Up Safety Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: High-Strength Steel Post locks in place on full extension, Post Pull-up loop provided at the top of the Post to assist in raising the Post.; release mechanism returns post to closed position. Post shall have controlled upward and downward movement.
2. Height: 42 inches above finished roof deck.
3. Material: Steel tube.
4. All Hardware: Type 316 Stainless Steel.
5. Balancing spring: A stainless steel spring balancing mechanism shall be provided to provide smooth, easy, controlled operation when raising and lowering the safety post. <>
6. Post: 1-5/8 inch diameter pipe.
7. Manufacturer: The Bilco Company (1-800-366-6530) or Architect approved equivalent.
8. Model: LU-1 (Steel - Yellow Powder Coat).

2.06 PIPE SUPPORTS

A. Pipe Supports: Adjustable-height, extruded-aluminum tube, filled with urethane insulation; 2 inches in diameter; with aluminum baseplate, EPDM base seal, manufacturer's recommended hardware for mounting to structure or structural roof deck as indicated, and extruded-aluminum carrier assemblies; suitable for quantity of pipe runs and sizes.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. DURA-BLOK
   b. MIRO Industries, Inc.
   c. Architect approved equivalent.
2. Pipe Support Height: As indicated on Drawings.
3. Roller Assembly: With stainless-steel roller, sized for supported pipes.
4. Pipe Support Flashing: Manufacturer's standard insulated sleeve flashing with integral base flange; aluminum sheet, 0.063 inch (1.60 mm) thick.
5. Finish: Manufacturer's standard.

2.07 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches (300 mm) high, with removable metal hood and slotted metal collar.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Custom Solution Roof and Metal Products
   b. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc
2. Metal: Aluminum sheet, 0.063 inch (1.60 mm) thick.
3. Diameter: As indicated.
4. Finish: Manufacturer's standard.

B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Custom Solution Roof and Metal Products
   b. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc
3. Metal: Aluminum sheet, 0.063 inch (1.60 mm) thick.

4. Height: 18 inches (457.2 mm).
5. Diameter: As indicated.
6. Finish: As selected by the Architect from the manufacturer's full line of finishes.

2.08 RETROFIT ROOF DRAINS

A. Retrofit Roof Drains: ANSI/SPRI RD-1 approved retrofit roof drain assemblies shall be SpeedTite Drain “drop-in ready” type with built-in Vortex Breaker technology for improved flow performance; 11 gauge (.125 inch), one piece aluminum body; 17-inch flange; heavy cast aluminum strainer dome and clamping ring; 10-inch length stem with SpeedTite Mechanical seal. Provide Model No. SPT3A (3 inch) or SPT4A (4 inch) sizes as required by field conditions.
   1. Manufacturer: OMG Roofing Products, (800) 633-3800 or approved equal.
   2. Install drains in strict compliance with manufacturer’s specifications and instructions.
   3. Modify stem and connected piping as required for a watertight installation adequate to drain the roof areas indicated.
   4. Provide new stainless steel clamping bolts for drain connections to existing drain bodies as required by field conditions.
   5. Provide cleaning of factory oils using a wash primer as recommended by the manufacturer to promote adhesion of roof materials to the drain flanges.

B. O-Ring Retrofit Roof Drains: Drains specifically designed for smaller or larger I.D. piping situations. ANSI/SPRI RD-1 approved retrofit roof drain assemblies shall be O-Ring RetroDrain type; 16 gauge (.064 inch), one piece aluminum body with 2 rubber O-rings; 17 ½-inch flange; heavy cast aluminum SuperDome strainer and clamping ring; 12-inch length stem with 2 rubber O-ring seals. Provide Model No. ALDCR2A (2 inch) size or as required by field conditions.
   1. Manufacturer: OMG Roofing Products, (800) 633-3800 or approved equal.
   2. Install drains in strict compliance with manufacturer’s specifications and instructions.
   3. Modify stem and connected piping as required for a watertight installation adequate to drain the roof areas indicated.
   4. Provide new stainless steel clamping bolts for drain connections to existing drain bodies as required by field conditions.
   5. Provide cleaning of factory oils using a wash primer as recommended by the manufacturer to promote adhesion of roof materials to the drain flanges.

2.09 STANDING SEAM MOUNTED ROOF EDGE RAILING SYSTEM

A. Acceptable Manufacturer: Kee Safety, Inc. Address: 100 Stradtman Street #8, Buffalo, NY 14206; Phone: 800-851-5181; Fax: 716-896-5696; Email: info@keesafety.com; Web: www.keesafety.com or Architect approved equivalent.
   1. Substitutions: See Section 012500 - Product Substitution Procedures and Section 016100 - Basic Product Requirements.

B. Roof Edge Protection: Provide freestanding KeeGuard Roof Edge Protection System, including pipe railings, uprights, bases, and fittings or Architect approved equivalent.
   1. Seam connected guardrail system with 42 inch (1067 mm) minimum height above walkway system to provide a pedestrian egress barrier on the roof to withstand a minimum load of 200 lb (90719 g) in any direction to the top rail per OSHA Regulation 29 CFR 1910.23.
   2. Pipe: Steel, 1-1/2 inches (48 mm) schedule 40, galvanized.

3. Tube: Galvanized tube, 12 gauge, 1-1/2 inches, 1.90 inches (48 mm) OD.
4. Rails and Posts: Galvanized Tube, 12 gauge, 1-1/2 inches 1.90 inches (38 mm) diameter.
5. Mounting Bases: Steel bases are galvanized and are supplied with a rubber pad on underside of the component.
6. Fasteners: stainless steel or galvanized.

C. Custom Design: Provide pipe, fittings, and accessories as indicated or required by Drawings to match design indicated.

D. Pipe:

1. Steel Pipe: Steel, 1-1/2 inches (38 mm) schedule 40, galvanized.
2. Tube: Galvanized tube, 12 gauge, 1-1/2 inches, 1.90 inches (48 mm) OD.

E. Fittings, Including Elbows, Crossovers, Wall flanges, Tees, Couplings:

1. Galvanized Malleable Cast Iron: Kee Klamp structural pipe fittings, ASTM A447 with ASTM A153 galvanizing.
2. Finish: Polyester factory applied spray coating. Color: as selected by the Architect form the manufacturer's full color offering.
3. Fasteners: Type 304 or 305 stainless steel or galvanized.

F. Factory fabricate to greatest extent practical with upright tops shall be plugged with weather and light resistant material. Assemble components with joints tightly fitted and secured. Accurately form components to suit installation.

G. Prepare surfaces using the methods recommended by the manufacturer. Install in accordance with manufacturer's instructions. Fit exposed connections accurately together to form tight joints. For all connections with Kee Klamp fittings, each set screw is to be tightened to 29 foot pounds (39 Nm) of torque.

2.10 STANDING SEAM MOUNTED WALKWAY SYSTEM (KEE WALK)

A. Rooftop Walkway Systems: Kee Walk as manufactured by Kee Safety Inc.

1. Description: Modular walkway system to provide anti-slip, level surface for demarcated route on roof, uniformly distributes pedestrian load; designed for roof types including metal profile standing seam, and membrane. Kee Walk can accommodate flat, barrel and pitched roofs and is also field-adjustable for sloping roofs up to 35 degrees.
2. Provide components including but not limited to clips, brackets, walkway modules and accessories with appropriate fasteners as indicated or required to match design indicated on Drawings and to provide complete installation.
3. Compliance:
   a. Fire rated to class HB of UL 94 (harmonized with ISO 9772).
   b. Slip Resistance:
      1) OSHA Standard 29 CFR 1910.29
4. Bearer Bars: Aluminum.
5. Treads: Fiberglass reinforced nylon; open tread design to allow water drainage.
6. System Configuration: As indicated on Drawings.
7. System Configuration: Traverse configuration; level walking surface mounted onto sub-frame fixed to roof. Two sections joined with hinged brackets at rear of assembly, rotating arms at front to level walking surface.

a. Modules: As scheduled and indicated on Drawings, as required to match design indicated on the Drawings and as required to provide complete installation. The following are available Modules for use:
   1) Modules: WW701ASSY 10ft Traverse Module for Up to 5 Degree Slopes.
   2) Modules: WW702ASSY 5ft Traverse Module for Up to 5 Degree Slopes.

8. System Configuration: Longitudinal configuration; factory pre-assembled, 12 treads per 10ft section (3 m); joined together by a 4 inch (102 mm) straight connector attached to bearer bars.
   a. Modules: As scheduled and indicated on Drawings, as required to match design indicated on the Drawings and as required to provide complete installation.
      1) Modules: WW711ASSY 10ft Steps Module 5 to 10 Degree Slopes.
      2) Modules: WW712ASSY 5ft Steps Module 5 to 10 Degree Slopes.

2.11 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.
   1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
   2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
   3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
   4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
3. Bed flanges in thick coat of roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof Curb Installation: Install each roof curb so top surface is level.

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. Pipe Support Installation: Install pipe supports so top surfaces are in contact with and provide equally distributed support along length of supported item.

F. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions.

G. Seal joints with butyl sealant as required by roof accessory manufacturer.

H. Walkway and Rail System Installation:

1. Install in accordance with manufacturer's instructions including the following:
   a. Fit exposed connections accurately together to form tight joints. For all connections with Kee-Klamp fittings, each set screw is to be tightened to 29-foot pounds (39 N-m) of torque.
   b. Perform cutting, drilling, and fitting required for installation of handrails. Set handrails and accurately in location, alignment, and elevation, measured from established lines and levels.
   c. Set posts plumb within a tolerance of 1/8 inch (3 mm).

3.03 REPAIR AND CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

B. Clean off excess sealants.

C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required for the correct installation of non-penetrating, recycled rubber rooftop supports for piping and ductwork systems.

1.02 REFERENCES

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

B. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.

C. ASTM C531 – Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts, Monolithic Surfaces, and Polymer Concretes

D. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2021.

E. ASTM C672 – Test Methods for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.

F. ASTM D395 - Standard Test Methods for Rubber Property—Compression Set; 2018.

G. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

H. ASTM D573 - Standard Test Method for Rubber — Deterioration in an Air Oven; 2004 (Reapproved 2019).

I. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2020.

J. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

A. See Section 013300 - {\t\#1000041}, for Submittal Procedures.

1.04 QUALITY ASSURANCE

A. Rubber / steel pipe supports shall be manufactured under a strict quality control program assuring quality product delivered to the jobsite. Pipe supports that are damaged shall not be installed.

B. Workmanship: All rooftop supports to be installed by a qualified contractor and installed in accordance with manufacturer’s recommendations.

1. All work shall comply with all applicable federal, state, and local codes and laws having jurisdiction.
2. All work shall conform to accepted industry and trade standards for pipe, and ductwork installations.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with these specifications, rooftop support systems shall be Dura-Blok™ design as supplied by Eaton or approved equal.

2.02 MATERIALS

A. Curb base shall be made of 100% recycled rubber and polyurethane prepolymer with a uniform load capacity of 500 pounds per linear foot of support*. In addition, each base to have a reflective red stripe. (*See PART 3, Article 3.01, Paragraph C)

B. Steel frame: Steel, strut galvanized per ASTM A653/A653M or strut galvanized per ASTM A653/A653M for bridge series.

C. Attaching hardware: Zinc-plated threaded rod, nuts and attaching hardware per ASTM B633.

D. Rooftop support system products shall meet or exceed the physical and performance characteristics as specified below:

1. Density: 0.52 oz/cu in. ASTM D575
2. Durometer Hardness: 67.2A ± 1. ASTM D575
3. Tensile Strength: 231 psi minimum. ASTM D575
4. Compression Deformation: 5% at 70psi and 72ºF. ASTM D395.
5. Brittleness at Low Temp: -50ºF. ASTM D746.
6. Weathering: 70 HOURS AT 120ºF. ASTM D573.
    a. Hardness Retained: 100% (±5%)
    b. Compressive strength: 100% (±5%)
    c. Tensile strength: 100% (±5%)
    d. Elongation retained: 100% (±5%)

2.03 TYPE OF ROOFTOP SUPPORTS

A. Continuous block channel pipe supports – Dura-Blok™ DB6-Series; Support shall consist of a 6 inch wide by 5 inch high rubber base with length of 9.6 inch length. 12 ga. galvanized channel. Standard strut accessories shall be used for attachment. Length of support shall extend a minimum of 2-inches from each side of the pipe(s) supported. Exact length to be coordinated in field. Assembly shall have 1” gaps between blocks for free flow of water.

B. Extendable height pipe support – Dura-Blok™ model DBE 10-12, height to suit application:12 inch (200 pound maximum load). Support shall consist of a 4-inch high rubber base with two (2) ½”-13 electro zinc all threaded rod risers and a 1” high galvanized slotted channel. Length of support to extend a minimum of 2-inches from each side of the pipe supported. Consult manufacturer as heavier loads may require CLDP load distribution plate.

C. Fixed height roller pipe supports– Dura-Blok™ DBR Series; Support shall consist of a 4-inch high rubber base with 1” high galvanized channel and a pipe roller assembly. Coordinate selection of support with manufacturer to accommodate size of pipe to be installed. Roller supports shall be available in the following pipe sizes: 2” to 3 1/2”, 4” to 6”, 8” to 10”, 12” to 14”, 16” to 20”. Support shall raise the pipe a minimum of 6”above the roof measured to bottom of supported pipe.

D. Adjustable height roller pipe supports– Dura-Blok™ DBR10 Series; Support shall consist of a 4-inch high rubber base with two (2) ½”-13 electro zinc all threaded rod risers and a B3114-3-1/2” pipe roll with sockets. Support shall be suitable for pipe up to 3-1/2 inches, with vertical adjustment up to 12 inches.

E. Elevated single pipe supports– Dura-Blok™ DBM Series; Support shall consist of a 4-inch high rubber base with one (1) 3/8”-16 electro zinc all threaded rod and a hinged pipe clamp. Supports shall be available in pipe sizes ranging from ½” to 2” and be suitable for supporting steel pipe or copper tubing. Coordinate clamp type with pipe material to be installed. Support shall raise the pipe approximately 11” above the roof measured to bottom of supported pipe.

F. Adjustable pipe supports for installations over 12” in height – Dura-Blok™ DB_DS Series; Support shall consist of two (2) 4-inch high rubber bases with 1” high galvanized channels and SH style riser channels. Riser channels shall be 1-5/8” x 1-5/8” x 12 ga. Support shall be capable of vertical adjustments between 12” and 50” measured to top of horizontal support channel.

G. Adjustable duct supports – Dura-Blok™ DB_DS Series; Support shall consist of two (2) 4-inch high rubber bases with 1” high galvanized channels and SH style riser channels. Riser channels shall be 1-5/8” x 1-5/8” x 12 ga. Support shall be capable of vertical adjustments between 12” and 50” measured to top of horizontal support channel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer’s instructions and recommendations. Coordinate overall dimensions of supports and pipe/duct to be supported in field with manufacturer prior to ordering.

B. Piping shall be elevated not less than 12 inches above the roof surface.

C. Ductwork shall be elevated not less than 30 inches above the roof surface.

D. If gravel top roof, gravel must be removed around and under support.

E. Support gas piping at intervals not exceeding the spacing specified in the Table below in accordance with the New York State Fuel Gas Code.

Steel Pipe, Nominal Size of Pipe (Inches)	**Maximum Horizontal Spacing of Supports (Feet)**
1/2	6
3/4 or 1	8
1-1/4 or Larger	10

F. Support hydronic piping systems at intervals not exceeding the spacing specified in the Table below in accordance with the New York State Mechanical Code, or in accordance with ANSI/MSS SP-58. Hydronic piping systems shall include steam, hot water, chilled water, steam condensate, and ground source heat pump loop systems.

Piping Materials	**Maximum Horizontal Spacing of Supports (Feet)**
ABS Pipe	4
Aluminum Pipe and Tubing	10
Cast-Iron Pipe	5
Copper or Copper-Alloy Pipe	12
Copper or Copper-Alloy Tubing	8
CPVC Pipe or Tubing, 1-Inch and Smaller	3
CPVC Pipe or Tubing, 1-1/4 Inches and Larger	4
Lead Pipe	Continuous
PB Pipe or Tubing	2-2/3 (32 Inches)
PE-RT, 1-Inch and Smaller	2-2/3 (32 Inches)
PE-RT, 1-1/4 Inches and Larger	4
PEX Tubing, 1-Inch and Smaller	2-2/3 (32 Inches)
PEX Tubing, 1-1/4 Inches and Larger	4
Polypropylene (PP) Pipe or Tubing, 1-Inch and Smaller	2-2/3 (32 Inches)
Polypropylene (PP) Pipe or Tubing, 1-1/4 Inches and Larger	4
PVC Pipe	4
Steel Tubing	8
Steel Pipe	12

G. Support ductwork in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible.

H. Use properly sized clamps to suit pipe and conduit sizes.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes sprayed fire-resistive materials (SFRM).

1.03 PRE-INSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Framing plans, schedules, or both, indicating the following:
   1. Extent of fire protection for each construction and fire-resistance rating.
   2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
   3. Minimum fire protection thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
   4. Treatment of fire protection after application.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Product Certificates: For each type of fire protection.

C. Evaluation Reports: For fire protection, from ICC-ES.

D. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fire protection manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

B. Mockups: Build mockups.
   1. Build mockup of each type of fire protection and different substrate 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.

1.07 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: a qualified testing agency to perform preconstruction testing on fire protection.
   1. Provide test specimens and assemblies representative of proposed materials and construction.

B. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.
   1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E736/E736M. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
   2. Density: Test for density according to ASTM E605/E605M. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
   3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fire protection.
   4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   5. For materials failing tests, obtain applied-fire protection manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.08 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fire protection when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fire protection, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly.

1.09 COORDINATION

A. Sequence and coordinate application of SFRM with other related work specified in other Sections to comply with the following requirements:
   1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
   2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
   3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
   4. Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.
   5. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.
   6. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.

7. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Assemblies: Provide fire protection, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fire protection from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction.

E. Low-Emitting Materials: Fire protection used within the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Asbestos: Provide products containing no detectable asbestos.

2.02 SPRAYED FIRE-RESISTIVE MATERIALS

A. SFRM : Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Grace, W. R. & Co. - Conn.; Grace Construction Products; Monokote Z106 & Monokote Z106/HY.
   b. Isolatek International; Cafco Blaze-Shield HP.
   c. Architect/Engineer approved equivalent.
2. Bond Strength: Minimum 2,000 lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E736/E736M.
3. Density: Not less than 22 lb/cu. ft. and as specified in the approved fire-resistance design, according to ASTM E605/E605M.
4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E605/E605M, whichever is thicker, but not less than 0.375 inch.
5. Combustion Characteristics: ASTM E136 shall be non-combustible.
6. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 0.
   b. Smoke-Developed Index: 0.
7. Compressive Strength: Material shall not deform more than 10 percent when subjected to a crushing force of 100 psi when tested in accordance with ASTM E761/E761M.
8. Corrosion Resistance: No evidence of corrosion according to ASTM E937/E937M .

9. Deflection: No cracking, spalling, or delamination according to ASTM E759/E759M.
10. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E760/E760M.
11. Air Erosion: Maximum weight loss of 0.000 g/sq. ft. (0.270 g/sq. m) in 24 hours according to ASTM E859/E859M.
12. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G21.
13. Finish: As selected by Architect from manufacturer's standard finishes Spray-textured finish.
14. Color: Grey

2.03 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fire protection and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fire protection manufacturer and complying with one or both of the following requirements:

1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Fire protection manufacturer shall be contacted for procedures on handling primed / painted steel.
3. Primer's bond strength in required fire-resistance design complies with specified bond strength for fire protection and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E736/E736M.

C. Bonding Agent: Product approved by fire protection manufacturer and complying with requirements in the UL "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fire protection manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fire protection.

E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fire protection manufacturer.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fire protection manufacturer. Include pins and attachment.

G. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by fire protection manufacturer for each fire-resistance design.

1. Product: Subject to compliance with requirements, provide "Cafco Bond-Seal or Cafco Bond-Seal Type X" by Isolatek International.

H. Topcoat: Suitable for application over applied fire protection; of type recommended in writing by fire protection manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:
   1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fire protection with substrates under conditions of normal use or fire exposure.
   2. Objects penetrating fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
   3. Substrates receiving fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.

B. Verify that roof construction, installation of roof-top HVAC equipment, and other related work is complete before beginning fire protection work.

C. Conduct tests according to fire protection manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fire protection materials during application.

B. Post signage "Slippery When Wet" and erect appropriate barriers to alert on-site personnel / workers of slippery conditions in the area(s) of Spray fire protection applications.

C. Clean substrates of substances that could impair bond of fire protection.

D. Prime substrates where included in fire-resistance design and where recommended in writing by fire protection manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fire protection.

E. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fire protection. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.03 APPLICATION

A. Construct fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fire protection work.

B. Comply with fire protection manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fire protection with other construction to minimize need to cut or remove fire protection.

1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.

D. Metal Decks:

1. Do not apply fire protection to underside of metal deck substrates until concrete topping, if any, has been completed.
2. Do not apply fire protection to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fire protection.
3. When roof traffic is anticipated, as in the case of periodic maintenance, roofing pavers shall be installed as a walkway to distribute the loads.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fire protection manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fire protection manufacturer.

F. Spray apply fire protection to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fire protection manufacturer.

G. Extend fire protection in full thickness over entire area of each substrate to be protected.

H. Install body of fire protection in a single course unless otherwise recommended in writing by fire protection manufacturer.

I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fire protection that differs in color from that of encapsulant over which it is applied.

J. Where sealers are used, apply products that are tinted to differentiate them from fire protection over which they are applied.

K. Provide a uniform finish complying with description indicated for each type of fire protection material and matching finish approved for required mockups.

L. Cure fire protection according to fire protection manufacturer's written recommendations.

M. Do not install enclosing or concealing construction until after fire protection has been applied, inspected, and tested and corrections have been made to deficient applications.

N. Finishes: Where indicated, apply fire protection to produce the following finishes:

1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
2. Spray-Textured Finish: Finish left as spray applied with no further treatment.

3.04 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Test and inspect as required by the NYSBC 1705.14.
   2. For reference, utilize AWCI - Inspection Procedure for Field-Applied Sprayed Fire Resistive Materials, Technical Manual 12-A; an annotated guide.

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fire protection for the next area until test results for previously completed applications of fire protection show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. fire protection will be considered defective if it does not pass tests and inspections.
   1. Remove and replace fire protection that does not pass tests and inspections, and retest.
   2. Apply additional fire protection, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.05 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Remove all fire protection application equipment and residual supplies from the site upon completion of the work of this section.

C. Protect fire protection, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fire protection will be without damage or deterioration at time of Substantial Completion.

D. As installation of other construction proceeds, inspect fire protection and repair damaged areas and fire protection removed due to work of other trades.

E. Repair fire protection damaged by other work before concealing it with other construction.

F. Repair fire protection by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Penetrations in fire-resistance-rated walls.
   2. Penetrations in horizontal assemblies.
   3. Penetrations in smoke barriers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product specified.

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1.04 FIELD QUALITY CONTROL

A. Section 014500 - QUALITY CONTROL: Field inspection and testing.
   1. Inspect the installed firestopping after application and curing for integrity, prior to its concealment.
   2. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings.
   3. Re-inspect the installed firestopping for integrity of fire protection, after installation of subsequent work.
   4. Provide written inspection report and certification to the Architect, indicating installation meets or exceeds requirements of contract documents.

1.05 FIELD MOCK-UP

A. Field Mock-up Installations: Prior to installing firestopping, erect mock-up installations for each type firestop system indicated in the Firestop Schedule to verify selections made and to establish standard of quality and performance by which the firestopping work will be judged by the Owner or Owner’s Representative. Obtain acceptance of mock-up installations by the Owner or Owner’s Representative before start of firestopping installation. Provide at least 72 hours notice to Owner or Owner’s Representative prior to inspection.

1.06 INFORMATIONAL SUBMITTALS

A. See Section 013300 - SUBMITTALS, for Submittal Procedures.

B. Qualification Data: For qualified Installer.

C. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

C. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
    a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
    b. Classification markings on penetration firestopping correspond to designations listed by the following:
        1) FM Global in its "Building Materials Approval Guide."
        2) UL Fire Resistance Directory.
            (a) Firestop Devices (XHJI)
            (b) Fire Resistance ratings (BXRH)
            (c) Through Penetration Firestop Systems (XHEZ)
            (d) Fill Voids or Cavity Materials (XHHW)
            (e) Forming Materials (XHKU)

D. Preinstallation Conference: Conduct conference at Project site.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.09 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilation's or, where this is inadequate, forced-air circulation.

1.10 COORDINATION

A. Do not use materials that contain flammable solvents.

B. Scheduling:

1. Schedule installation of Cast in Place firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather Conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

F. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

G. Coordinate sizing of sleeves, openings, core-drilled holes, Cast-in place sleeves or cut openings to accommodate penetration firestopping.

H. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

I. Coordinate sizing of sleeves, openings, core-drilled holes, Cast-in place sleeves or cut openings to accommodate penetration firestopping.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hilti, Inc.
2. 3M Fire Protection Products.

3. STI Firestop
4. Tremco, Inc.; Tremco Fire Protection Systems Group.
5. USG Corporation.

2.02 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist 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.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. Fire-resistance-rated walls include fire walls fire-barrier walls smoke-barrier walls and fire partitions.
   2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. Horizontal assemblies include floors floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
   2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
   3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

G. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

H. 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 manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:
    a. Slag-wool-fiber or rock-wool-fiber insulation.
    b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
    c. Fire-rated form board.
    d. Fillers for sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

I. Identification Labels:

1. Furnished by fire stopping manufacturer of suitable material for permanent field identification of through-penetration firestops.
2. Identify the following:
    a. Warning Wording
    b. Manufacturer Name.
    c. Product Catalog number.
    d. Tested System number.
    e. F-rating.
    f. T-rating, if applicable.
    g. Firestop Contractor name.
    h. Firestop Contractor Contact Number.
    i. Firestop Inspection Date & Inspector Initials.
3. Field fabricated labels are not acceptable.

2.03 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

1. Hilti CP 680 M or P Cast-In-Place Firestop Device
    a. Add Aerator adapter when used in conjunction with aerator ("sovent") system.
2. Hilti CP 681 Tub Box Kit for use with tub installations.
3. Specified Technologies Inc. CID cast-in devices.

B. Sealants, caulking materials or foams for use with non-combustible items including steel pipe. copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:

1. Hilti FS-ONE MAX Intumescent Firestop Sealant.
2. Hilti CP 604 Self-leveling Firestop Sealant.
3. Hilti CP 620 Fire Foam
4. Hilti CP 606 Flexible Firestop Sealant
5. Hilti CP 601s Elastomeric Firestop Sealant.

C. Sealants, caulking materials or foams for use with sheet metal ducts the following products are acceptable:
   1. Hilti FS-ONE MAX Intumescent Firestop Sealant.
   2. Hilti CP 606 Flexible Firestop Sealant
   3. Hilti CP 601s Elastomeric Firestop Sealant:

D. Firestop Joint Spray: sprayable fire-rated mastic for deck flutes and joints where greater movement is expected:
   1. Hilti Firestop Joint Spray CFS-SP-WB.

E. Mineral Wool plugs for filling steel deck flute and wall gap openings:
   1. Hilti CP 777 Friction Fit sized and cut to depth for deck flute openings as recommended by the manufacturer.
   2. Hilti CP 767 continuous filler strip for filling continuous gaps at top of walls.

F. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
   1. Hilti FS-ONE MAX Intumescent Firestop Sealant
   2. Hilti CP 620 Fire Foam
   3. Hilti CP 601s Elastomeric Firestop Sealant
   4. Hilti CP 606 Flexible Firestop Sealant.

G. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

H. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
   1. Hilti FS-ONE MAX Intumescent Firestop Sealant
   2. Hilti CP 604 Self-leveling Firestop Sealant

I. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with steel lining on one side.
   1. Hilti CP 643N Firestop Collar
   2. Hilti CP 644 Firestop Collar.
   3. Hilti CP 645 / 648 E Wrap Strips.

J. 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.
   1. Acceptable materials are "BIO FIRESHIELD "Novasit K-10".

K. Pillows/Bags / Pads: 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.
   1. Hilti CP 617 Firestop Putty Pad

L. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
   1. Hilti FS-ONE MAX High Performance Intumescent Firestop sealant

2. Hilti CP 620 Fire Foam
3. Hilti CP 601s Elastomeric Firestop Sealant.
4. Hilti CP 606 FS Flexible Firestop Sealant.

M. Sleeves: Re-penetrable cable management device for electrical and telecommunication cabling and cable bundles for use with appropriate Firestopping sealant, fill mortar, putty or other devices and materials. Concrete assemblies up to 3 hour and Gypsum Board assemblies up to 4 hour.

1. Hilti CP 653 Speed Sleeve.

N. Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti CP 618 Firestop Putty Stick
2. Hilti CP 658T Firestop Plug.

O. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

P. Non-curing, re-penetrable materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable.

1. Hilti FS 657 Fire Block
2. Hilti CP 675T Firestop Board / Brick

Q. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes. electrical busways in raceways, the following products are acceptable:

1. Hilti FS 637 Trowelable Firestop Compound.

R. Mineral Fiber Fire Safing insulation:

1. Provide insulation as manufactured by USG INTERIORS, INC. Product "Thermafiber Safing", CAFCO INDUSTRIES LTD., FIBREX INC. or approved equal. Density shall be 4 pcf with thickness to suit condition
   a. Provide 20 gauge minimum metal plate where required for fire safing support to comply with fire ratings
   b. Do not use fibrous safing insulation unless it is in conjunction with a compatible smoke seal as specified herein.

S. Mineral Wool

1. Loose mineral wool, rated noncombustible when tested according to ASTM E136, free of asbestos and glass fiber, and suitable for stuffing into metal deck flutes to an in place density of 6 to 12 pcf.

2.04 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping 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

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

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

3.02 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion.

B. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

C. Priming: 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.

D. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping seal with substrates.

3.03 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

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 indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.

2. Apply materials so they contact and adhere to substrates formed by 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.

3.04 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. 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. Identify the following:
   a. "WARNING - FIRESTOP MATERIAL - DO NOT DISTURB. NOTIFY BUILDING MANAGEMENT OF ANY DAMAGE".
   b. Manufacturer Name: _____.
   c. Product Catalog number:_____.
   d. Tested System number: _____.
   e. F rating:_____.
   f. T rating, if applicable.
   g. Firestop Contractor name:_____.
   h. Firestop Contractor Contact Number: _____.
   i. Firestop Inspection Date & Initials:_____.
   j. T-rating, if applicable.
   k. Firestop Contractor name.
   l. Firestop Contractor Contact Number.
   m. Firestop Inspection Date & Inspector Initials.

3.05 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping 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 penetration firestopping is 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 penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Joints in or between fire-resistance-rated constructions.
   2. Joints at exterior curtain-wall/floor intersections.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.
   1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.04 INFORMATIONAL SUBMITTALS

A. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

B. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

C. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
   1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.

2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
   a. Fire-resistive joint system products bear classification marking of qualified testing agency.
   b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
   c. UL - “Fire Resistance Directory."

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.07 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.01 FIRE-RESISTIVE JOINT SYSTEMS

A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E1966 or UL 2079:
   1. Joints include those installed in or between fire-resistance-rated walls floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
   2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
   3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Hilti, Inc.
      b. 3M Fire Protection Products.
      c. Cemco - Cemco Hotrod Type-X.
      d. Or approved equal

C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E119 based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa) or ASTM E2307.
   1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
   2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Hilti, Inc.
      b. 3M Fire Protection Products.
      c. Or approved equal.

D. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

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

3.02 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.03 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
   2. Apply fill materials so they contact and adhere to substrates formed by joints.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. 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. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.05 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.

C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.06 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or

deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.07 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.

B. Floor-to-Floor, Fire-Resistive Joint Systems:
   1. UL-Classified Systems: FF-S-Insert .
   2. Assembly Rating: 1 hour 2 hours.
   3. Nominal Joint Width: As indicated.
   4. Movement Capabilities: Class I - 15 percent compression, extension, or horizontal shear.
   5. L-Rating at Ambient: Less than Insert cfm/ft. (cu. m/s x m).
   6. W-Rating: No leakage of water at completion of water leakage testing.

C. Wall-to-Wall, Fire-Resistive Joint Systems FRJS-Insert:
   1. UL-Classified Systems: WW-S-Insert.
   2. Assembly Rating: 1 hour 2 hours.

D. Floor-to-Wall, Fire-Resistive Joint Systems FRJS-Insert:
   1. UL-Classified Systems: FW-S-insert .
   2. Movement Capabilities: Class I - 15 percent compression, extension, or horizontal shear.

E. Head-of-Wall, Fire-Resistive Joint Systems FRJS-Insert:
   1. UL-Classified Systems: HW-S-Insert.

F. Bottom-of-Wall, Fire-Resistive Joint Systems FRJS-insert:
   1. UL-Classified Systems: BW-S-insert .
   2. Assembly Rating: 1 hour 2 hours.

G. Perimeter Fire-Resistive Joint Systems PFRJS-insert:
   1. UL-Classified Perimeter Fire-Containment Systems: CW-S-insert.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Silicone joint sealants.
   2. Polyurethane joint sealants.
   3. Latex joint sealants.
   4. Preformed joint sealants.
   5. Acoustical joint sealants.

1.03 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Use ASTM C1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Samples for Verification: For each type of sealant submit a color sample board and one sample joint, 1/2 inch wide by 6 inches long including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
   5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.04 ACTION SUBMITTALS

A. See Section 013300 - SUBMITTALS, for Submittal Procedures.

B. Product Data: For each joint-sealant product indicated.

C. 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.

D. 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.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and testing agency.

B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

D. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

E. Warranties: Sample of special warranties.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project with a minimum of three (3) years experience in the installation of the work of this section.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.
2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.07 PROJECT 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 degrees 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.

1.08 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which 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's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two (2) 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 structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from natural 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.

PART 2 - PRODUCTS

2.01 MATERIALS, 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. VOC Content of Interior Sealants: Sealants and sealant primers used inside the 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. Liquid-Applied Joint Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.
   1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Stain-Test-Response Characteristics: Where sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for Project.

E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full color range.

G. Sealant Abbreviations:

   Use (related to application)

1. NT = Non-Traffic
2. T = Traffic

Type

1. S = Single Component
2. M = Multi-component
3. LM = Low Modulus
4. C = Clear
5. OP = Opaque

Grade

1. NS = Non-Sag
2. NF = Non-Flexible
3. P = Pourable
4. SL = Self-Leveling

Use (related to Contact Material)

1. M = Mortar Contact
2. G = Glass Contact
3. A = Aluminum Contact
4. O = Other Materials
5. I = Immersible

2.02 SILICONE JOINT SEALANTS

A. Single-Component, Non-sag, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, for Use (application) T; Use (for materials) M and O.

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. Dow Corning Corporation; DOWSIL 790.
    b. GE Advanced Materials - Silicones; SCS2000 SilPruf LM.
    c. Pecora Corporation; 301 NS
    d. Sika Corporation, Construction Products Division; SikaSil-WS 290
    e. Tremco Incorporated; Spectrem 1.

B. Single-Component, Non-sag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, for Use (application) T; Use (for materials) M and O

1. Products: Subject to compliance with requirements, provide the following:
    a. Pecora Corporation; 311 NS.
    b. Sika Corporation, Construction Products Division; SilkaSil-728 NS.
    c. Tremco Incorporated; Spectrem 800.

C. Single-Component, Pourable, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade P, Class 100/50, for Use (application) T; Use (for materials) M

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Dow Corning Corporation; 890-SL.
    b. Pecora Corporation; 310 SL.
    c. Sika Corporation, Construction Products Division; SilkaSil-728 SL.
    d. Tremco Incorporated; Spectrem 900 SL.

D. Mildew-Resistant, Single-Component, Nonsag, Non-staining, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, for Use (application) NT; Use (for materials) M, G, A, and O

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Tremco Incorporated: Tremsil 200.
   b. Pecora Corporation; 898 NST.
   c. GE Advanced Materials; SCS1700 Sanitary.

2.03 POLYURETHANE JOINT SEALANTS

A. Single-Component, Non-sag, non-staining, non-yellowing, moisture curing, paintable, Low VOC, Hybrid Polyurethane (STPU), Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, for Use NT; Use (for materials) M, G, A, and O

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Sika Corporation, Construction Products Division; Sikaflex - 15LM.
   b. Pecora Corporation; Dynatrol I-XL.
   c. Tremco Incorporated; Dymonic 100.

B. Single-Component, nonsag, traffic-grade, moisture cured, paintable, fire resistant, Polyurethane Joint Sealant: ASTM C920. Type S Grade NS, Class 35, for Use (application) NT; Use (for materials) M, A, O, and I

1. Products: Subject to compliance with requirements, provide one of the following:
   a. BASF; Masterseal NP1.
   b. Sika Corporation, Construction Products Division; Sikaflex - 1a.
   c. Tremco Incorporated; Dymonic 100.

C. Single-Component, Pourable, Traffic-Grade, moisture cured, Polyurethane Joint Sealant: ASTM C920, Type S, Grade P, Class 35, for Use (application) T; Use (for materials) M, A, and O

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. BASF; MasterSeal SL 1.
   b. Pecora Corporation; Urexpan NR-201.
   c. Sherwin-Williams Company, Loxon SL1 Self-Leveling.
   d. Sika Corporation. Construction Products Division; Sikaflex - 1CSL.
   e. Tremco Incorporated; Vulkem 45 SSL.

D. Immersible Multicomponent, Nonsag, Traffic-Grade, Chemically curing, Polyurethane Joint Sealant: ASTM C920, and meets ASTM C1247 test requirements, Type M, Grade NS and SL, Class 25, for Use (application) T; Use (for materials) M, A, O, and I.

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. Sika Corporation, Construction Products Division, Sikaflex - 2c NS EZ
   b. Master Builders Solutions; MasterSeal NP 2.
   c. Pecora Corporation; Dynatred.
   d. Tremco Incorporated; Dymeric 240 FC.

2.04 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

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. BASF; MasterSeal NP 520.
    b. GE Advanced Materials; Ultra Seal.
    c. Pecora Corporation; AC-20+.
    d. Tremco Incorporated; Tremflex 834.
    e. Sherwin Williams Company (SherMax Urethanized Elastomeric Sealant).

2.05 PREFORMED JOINT SEALANTS

A. Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from Polyurethane foam with minimum density of 10 lb/cu. ft. (160 kg/cu. m) and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

1. Products: Subject to compliance with requirements, provide the following:
    a. Tremco Incorporated; Spectrum SimpleSeal.
    b. Tremco Incorporated; Illmod 600
    c. Emseal Joint Systems, Ltd.; 25V.
    d. Schul International Company; Sealtite Standard.

2.06 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard non-sag, fire resistant, paintable, non-staining acrylic latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.

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. Pecora Corporation; AC-20 FTR.
    b. Sherwin-Williams Company, Sher-Max Urethanized Elastomeric Sealant
    c. Tremco Incorporated; Tremflex 834, Acoustical/Curtain Wall Sealant
    d. USG Corporation; SHEETROCK Acoustical Sealant.

2.07 BUTYL SEALANTS

A. Butyl Sealant: Manufacturer's non-skinning, non-hardening, non-bleeding permanently flexible gun grade compound to limit sound transmission, seal painted and aluminized metal panels and to act as a vapor barrier for polyethylene barrier films complying with ASTM C919, Use (application) NT; Use (for materials) M, G, A, and O.

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. Pecora Corporation; BA-98.
    b. DOWSIL 335 Butyl Sealant

B. Butyl Sealant: Manufacturer's one-part gun grade compound formulated from virgin butyl rubber for use as a sealing and glazing compound complying with ASTM C1311, Type S, for Use (application) NT; Use (for materials) M, G, A, and O.

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. Pecora Corporation; BC-158.
   b. Tremco; Tremco Butyl Sealant

2.08 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) 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.

2.09 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: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 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 joint-sealant performance.

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

3.02 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.
   c. Unglazed surfaces of ceramic tile.
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. Glass.

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.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. 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.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. 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.

F. 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 C1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C1193.
    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations and at perimeters of acoustical Panel edge channels of Acoustical Panel Ceiling systems. with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written recommendations.

3.04 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 1 test for each 500 feet of joint length thereafter or 1 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 C1193 or Method A, Tail Procedure, in ASTM C1521.
    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 passes 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 fill, 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.

3.05 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.

3.06 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 and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.07 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
   1. Joint Locations:
      a. Control and expansion joints in paver and pavement installations.
      b. Isolation and contraction joints in cast-in-place concrete slabs.
      c. Tile control and expansion joints.
   2. Sealant Types:
      a. Silicone Joint Sealant: Single component, non-sag, traffic grade, neutral curing.
      b. Polyurethane Joint Sealant: Single component, pourable, traffic grade.
      c. Preformed Joint Sealant: Preformed foam sealant.
   3. Joint-Sealant Colors: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion.
   1. Joint Locations:
      a. Joints in pedestrian plazas.
   2. Sealant Types:
      a. Polyurethane Joint Sealant: Immersible, multicomponent, non-sag, traffic grade.
   3. Joint-Sealant Colors: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal non-traffic surfaces.
   1. Joint Locations:
      a. Construction joints in cast-in-place concrete.
      b. Control and expansion joints in unit masonry.
      c. Joints in dimension stone cladding.
      d. Joints between metal panels.
      e. Joints between different materials listed above.

f. Perimeter joints between materials listed above and frames of doors windows and louvers.
g. Control and expansion joints in ceilings and other overhead surfaces.

2. Sealant Types:
   a. Silicone Joint Sealant: Single component, non-sag, neutral curing, Class 100/50.
   b. Polyurethane Joint Sealant: Single component, non-sag, Class 100/50.
3. Joint-Sealant Colors: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:
   a. Isolation joints in cast-in-place concrete slabs.
   b. Control and expansion joints in tile flooring.
2. Sealant Type:
   a. Polyurethane Joint Sealant: Single component, non-sag, traffic grade.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal non-traffic surfaces.

1. Joint Locations:
   a. Perimeter joints of exterior openings where indicated.
   b. Tile control and expansion joints.
   c. Vertical joints on exposed surfaces of walls and partitions.
   d. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
2. Sealant Type:
   a. Latex Acrylic based Joint Sealant.
3. Joint-Sealant Colors: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal non-traffic surfaces.

1. Joint Sealant Location:
   a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   b. Tile control and expansion joints where indicated.
2. Sealant Type:
   a. Silicone Joint Sealant: Mildew resistant, single component, non-sag, neutral curing.
3. Joint-Sealant Colors: As selected by Architect from manufacturer's full range of colors.

G. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal non-traffic surfaces.

1. Joint Location:
   a. Acoustical joints where indicated.
   b. Other joints as indicated.
2. Joint Sealant: Acoustical joint sealant.

3.08 SEALANT INSTALLATION LOG

A. A tabular log of all sealant installations on the project shall be be keep and submitted with the O & M manuals at the completion of the project.

B. Tabular log shall have columns for:

1. Sealant type
2. Sealant installation location

3. Temperature during installation
4. Date of Installation
5. Manufacturer
6. Sealant color installed.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Interior expansion control systems.
   2. Exterior wall expansion control systems.

1.03 ACTION SUBMITTALS

A. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, blockout requirement, attachments to other work, and line diagrams showing entire route of each expansion control system. Where expansion control systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

B. Samples: For each exposed expansion control system and for each color and texture specified, full width by 6 inches (152 mm) long in size.

C. Product Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
   1. Manufacturer and model number for each expansion control system.
   2. Expansion control system location cross-referenced to Drawings.
   3. Nominal joint width.
   4. Movement capability.
   5. Classification as thermal or seismic.
   6. Materials, colors, and finishes.
   7. Product options.

1.04 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire barrier provided as part of an expansion control system, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
   1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
   2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.

B. Coordination: Coordinate installation of exterior wall expansion control systems with roof expansion control systems to ensure that wall transitions are watertight. Roof expansion joint assemblies are specified elsewhere.

2.02 MATERIALS

A. Aluminum: ASTM B221, Alloy 6005A-T61, 6063-T5, 6061-T5, 6105-T5 for extrusions; ASTM B209, Alloy 6061-T6, 3003-H14, 5005-H34 for sheet and plate.
   1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Stainless Steel: ASTM A666/A666M, Type 304 for plates, sheet, and strips.
   1. Finish: No.4, directional satin.
      a. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
      b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

C. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.

D. Compression Seals: ASTM D2000; preformed rectangular elastomeric extrusions having internal baffle system and designed to function under compression.

E. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required rating period.

F. Moisture Barrier: 7-ply laminate reinforced Polyethylene.

G. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.03 INTERIOR EXPANSION CONTROL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or a comparable product by one of the following:
   1. Inpro Corporation. (Basis of Design)
   2. Construction Specialties, Inc.
   3. Balco, Inc.
   4. MM Systems Corporation.

C. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

D. Floor-to-Floor:
   1. Basis-of-Design Product: Inpro.
   2. Type: Recessed Mount Seismic Floor Cover, ASTM E1399
   3. Model: 223 Series - A01 Floor to Floor

4. Design Criteria:
    a. Nominal Joint Width: 2 inch or as indicated on the drawings
    b. Load Capacity:
        1) Uniform Load: Moderate
    c. Fire Resistance: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.
5. Type: Recessed Cover Plate.
    a. Metal: Aluminum.
        1) Finish: Mill Aluminum
    b. Seal Material: VOC compliant, Dual durometer Thermoplastic Rubber Gasket (heat weldable): as selected by the Architect.
    c. Recess Depth: 3/8 inch or as indicated on the drawings
6. Attachment Method: Mechanical Anchors.
7. Warranty: Five-Year Warranty

2.04 EXTERIOR WALL EXPANSION CONTROL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
    1. Construction Specialties, Inc. (Basis of Design)
    2. EMSEAL Corporation.
    3. MM Systems Corporation.
    4. Watson Bowman Acme Corp.; a BASF Construction Chemicals business.
B. Wall-to-Wall:<>
    1. Basis-of-Design Product: AFW200X (2"joint).
    2. Design Criteria:
        a. Nominal Joint Width: As indicated on Drawings.
    3. Type: Cover plate.
        a. Metal: Aluminum.
            1) Finish: Clear Anodic, Class II.
    4. Type: Preformed cellular foam.
        a. Foam Material: Manufacturer's standard.
            1) Color: As selected by Architect from manufacturer's full range.

2.05 MATERIALS

A. Aluminum: ASTM B221, Alloy 6063-T5 for extrusions; ASTM B209, Alloy 6061-T6 for sheet and plate.
    1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
B. Elastomeric Seals: ASTM E1783; preformed elastomeric membranes or extrusions to be installed in metal frames.
C. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.
D. Elastomeric Concrete: Modified epoxy or polyurethane extended into a prepackaged aggregate blend, specifically designed for bonding to concrete substrates.
E. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required fire-resistance rating.

F. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

G. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.06 GENERAL FINISH REQUIREMENTS

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: 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.

2.07 ALUMINUM FINISH REQUIREMENTS

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: Noticeable variations in same piece are not acceptable

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces where expansion control systems will be installed for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to expansion control system manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion control systems.

3.03 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.

B. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
   1. Provide in continuous lengths for straight sections.
   2. Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
   3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

C. Foam Seals: Install with adhesive recommended by manufacturer.

D. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.

3.04 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion control systems. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION

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PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. This Section references specification sections relating to commercial door hardware for the following:
   1. Swinging doors.

B. Commercial door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical and access control door hardware.
   3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
   4. Automatic operators.
   5. Cylinders specified for doors in other sections.

1.03 RELATED REQUIREMENTS

A. Section 087100 - DOOR HARDWARE.

1.04 CODES AND REFERENCES

A. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ICC A117.1 - Accessible and Usable Buildings and Facilities.
   2. ICC (IBC) - International Building Code.
   3. NFPA 70 - National Electrical Code.
   4. NFPA 80 - Fire Doors and Windows.
   5. NFPA 101 - Life Safety Code.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. State Building Codes, Local Amendments.

B. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.
   1. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
   2. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
   3. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2022.
   4. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
   5. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

1.05 SUBMITTALS

A. See Section 013300 - SUBMITTALS, for submittal procedures.

B. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

C. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
   2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
   3. Content: Include the following information:
      a. Type, style, function, size, label, hand, and finish of each door hardware item.
      b. Manufacturer of each item.
      c. Fastenings and other pertinent information.
      d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
      e. Explanation of abbreviations, symbols, and codes contained in schedule.
      f. Mounting locations for door hardware.
      g. Door and frame sizes and materials.
   4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

D. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

E. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

G. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

1.06 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of Door Hardware specified in the Related Sections from a single source, qualified supplier unless otherwise indicated.

E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ICC A117.1 requirements and guidelines as directed in the applicable model building code.

F. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.08 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.09 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1.10 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

1.11 WARRANTY

A. See Section 017800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.

PART 2 PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. See Section 087100 - DOOR HARDWARE[].

PART 3 EXECUTION

3.01 DOOR HARDWARE SETS

A. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products as listed in the door hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Products listed in the Door Hardware Sets must meet the requirements described in the specification sections noted.
   1. Section 087100 - DOOR HARDWARE.

D. Manufacturer’s Abbreviations:

   1. MK - McKinney

   2. PE - Pemko

   3. RF - Rixson

   4. RO - Rockwood

   6. SA - Sargent

HARDWARE SCHEDULE

Set: HS1

2	Continuous Hinge	MCK-25HD	CL	MK	087100
2	Concealed Vert Rod Exit	12 43 WD8613 ETP	US32D	SA	087100
2	Door Closer	351 UO	EN	SA	087100
2	Kick Plate	K1050 12" high BEV CSK	US32D	RO	087100
2	Concealed Overhead Stop	1-X36	630	RF	087100
1	Gasketing	S773BL		PE	087100
1	Astragal	S772BL		PE	087100

Set: HS2

1	Continuous Hinge	MCK-25HD	CL	MK	087100
1	Storeroom Lock	28 11G04 BP	US26D	SA	087100
1	Concealed Overhead Stop	1-X36	630	RF	087100
1	Door Closer	351 UO	EN	SA	087100

Set: HS3

NOT USED

Set: HS3

NOT USED

Set: HS5

1	Continuous Hinge	MCK-25HD	CL	MK	087100
1	Classroom Security Lock	28 11G38 BP	US26D	SA	087100
1	Concealed Overhead Stop	1-X36	630	RF	087100
1	Door Closer	351 UO	EN	SA	087100
1	Kick Plate	K1050 12" high BEV CSK	US32D	RO	087100
1	Gasketing	S773BL		PE	087100

Set: HS6

2	Continuous Hinge	MCK-12HD	CL	MK	087100
1	Removable Mullion	L980	PC	SA	087100
1	Rim Exit Device	16 43 8804	US32D	SA	087100
1	Rim Exit Device	16 43 8810	US32D	SA	087100
1	Cylinder	980C1	US26D	SA	087100
2	Door Closer	351 CPS	EN	SA	087100
1	Threshold	255x5AFG		PE	087100

Set: HS6A

2	Continuous Hinge	MCK-12HD	CL	MK	087100
1	Electrified Mullion	EL980	PC	SA	087100
1	Rim Exit Device	16 43 8804	US32D	SA	087100
1	Rim Exit Device	16 43 8810	US32D	SA	087100
1	Cylinder	980C1	US26D	SA	087100
1	Electric Strike	9600	630	HS	087100
2	Door Closer	351 CPS	EN	SA	087100
1	Threshold	255x5AFG		PE	087100

Set: HS7A

1	Continuous Hinge	MCK-12HD	CL	MK	087100
1	Rim Exit Device	16 43 8804	US32D	SA	087100
1	Electric Strike	9600	630	HS	087100
1	Door Closer	351 CPS	EN	SA	087100
1	Threshold	255x5AFG		PE	087100

Set: HS8

1	Continuous Hinge	MCK-25HD	CL	MK	087100
1	Classroom Lock	28 11G37 BP	US26D	SA	087100
1	Concealed Overhead Stop	1-X36	630	RF	087100
1	Door Closer	351 UO	EN	SA	087100
1	Kick Plate	K1050 12" high BEV CSK	US32D	RO	087100
1	Gasketing	S773BL		PE	087100

Set: HS9

1	Continuous Hinge	MCK-25HD	CL	MK	087100
1	Privacy Set	28 11U65 BP	US26D	SA	087100
1	Concealed Overhead Stop	1-X36	630	RF	087100
1	Door Closer	351 UO	EN	SA	087100
1	Kick Plate	K1050 12" high BEV CSK	US32D	RO	087100

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal frames for non-hollow metal doors.

B. Fire-rated hollow metal frames for non-hollow metal doors.

C. Interior glazed borrowed lite and transom frames.

1.02 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2018.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

I. ASTM C476 - Standard Specification for Grout for Masonry; 2020.

J. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2016.

K. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

L. ITS (DIR) - Directory of Listed Products; Current Edition.

M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

O. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2017.

P. NFPA 80 -Standard for Fire Doors and Other Opening Protectives; 2013

Q. UL (DIR) - Online Certifications Directory; Current Edition.

R. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; 2009

1.03 SUBMITTALS

A. See Section 013300 - {\t\#1000041} for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with applicable requirements and in compliance with standards and/or custom guidelines as indicated.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Frames with Integral Casings:

1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
2. Republic Doors: www.republicdoor.com.
3. Steelcraft, an Allegion brand: www.allegion.com/sle.
4. Or approved equal.

2.02 PERFORMANCE REQUIREMENTS

A. Refer to Door and Frame Schedule on the drawings for frame sizes, fire ratings, sound ratings, finishing, door hardware to be installed, and other variations, if any.

B. Door Frame Type: Provide hollow metal door frames with integral casings.

C. Steel used for fabrication of frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.

D. Accessibility: Comply with ICC A117.1 and ADA Standards.

E. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Flush.

F. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an

exterior frame that is also indicated as being sound-rated must comply with the requirements specified for exterior frames and for sound-rated frames; where two requirements conflict, comply with the most stringent.

G. Hardware Preparations, Selections and Locations: Comply with BHMA A156.115, NAAMM HMMA 830 and NAAMM HMMA 831 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

H. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

I. Mullions for Pairs of Doors: Fixed, except where removable is indicated, with profile similar to jambs.

J. Frames for Interior Glazing or Borrowed Lites: Construction and face dimensions to match door frames, and as indicated on drawings.

K. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high (102 mm) to fill opening without cutting masonry units.

2.03 HOLLOW METAL DOOR FRAMES WITH INTEGRAL CASINGS

A. Frame Finish: Factory primed and field finished.

B. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 3 - Extra Heavy-duty.
   b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Frame Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.

C. Fire-Rated Door Frames:

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 3 - Extra Heavy-duty.
   b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Frame Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with {\rs\#2} or AA DAF-45 ("positive pressure fire tests").
3. Provide units listed and labeled by ITS (DIR) or UL (DIR).
   a. Attach fire rating label to each fire rated unit.

2.04 ACCESSORIES

A. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

B. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches (102 mm) as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

C. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames with bituminous coating to a thickness of 1/16 inch.

3.03 INSTALLATION

A. Install frames in accordance with manufacturer's instructions and related requirements of specified frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Coordinate installation of glazing.

E. Coordinate installation of hardware.

F. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edges, crossed corner to corner.

3.05 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Solid-core doors with wood-veneer faces.
   2. Factory finishing flush wood doors.
   3. Factory fitting flush wood doors to frames and factory machining for hardware.
   4. Light frames and glazing installed in wood doors.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
   1. Dimensions and locations of blocking.
   2. Dimensions and locations of mortises and holes for hardware.
   3. Dimensions and locations of cutouts.
   4. Undercuts.
   5. Requirements for veneer matching.
   6. Doors to be factory finished and finish requirements.
   7. Fire-protection ratings for fire-rated doors.

C. Samples for Verification:
   1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish.
   2. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.04 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body and is a certified participant in AWI's Quality Certification Program.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

C. Fire Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated,

based on testing at positive pressure according to NFPA 252 (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire Rated Door Assemblies: For units exceeding sizes of tested assemblies provide manufacturer’s construction label, indicating compliance to independent 3rd party certification agency’s procedure, except for size.
2. Temperature Rise Limit: Where required and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire test exposure.

D. Smoke Control Door Assemblies: Comply with NFPA 105.

1. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.07 FIELD CONDITIONS

A. Environmental Limitations: 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 ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

B. Environmental Limitations: 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 between 60 and 90 deg F and relative humidity between 43 and 70 percent during remainder of construction period.

1.08 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. Warping (bow, cup, or twist) more than 1/4 inch in a 42 by 84-inch section.
   b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3 inch span.
2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.
4. Warranty Period for Hollow-Core Interior Doors: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. VT Industries, Inc.; Heritage Series
2. Masonite Architectural.
3. Or approved equal.

B. Source Limitations: Obtain flush wood doors indicated to be blueprint matched with paneling from single manufacturer.

2.02 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards WDMA I.S. 1A, "Architectural Wood Flush Doors."

1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.

B. ICC A117.1 - Accessible and Usable Buildings and Facilities.

C. WDMA I.S. 1A Performance Grade: Heavy Duty and Extra Heavy Duty as specified.

D. WDMA I.S. 1A Performance Grade:

1. Heavy Duty unless otherwise indicated.
2. Extra Heavy Duty: public toilets, janitor's closets and assembly spaces.
3. Standard Duty: Closets (not including janitor's closets) .

E. Fire-Rated Wood Doors: Doors 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.

1. Temperature-Rise Limit: Where indicated, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
2. Cores: Provide stave lumber core or mineral core as needed to provide fire-protection and positive pressure rating indicated.
3. Pairs: 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.
4. Electronic Barcode: “VTsmartdoor” barcode technology.
   a. Location: Fire label, hinge stile of doors.
   b. Provide fire-rated door assembly information required for Owner’s annual fire-door inspection in accordance with NFPA 820, Paragraph 5.2.1.

F. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
   a. 5-inch top-rail blocking (HB-1).
   b. 5-inch bottom-rail blocking, in doors indicated to have protection plates (HB-2).
   c. 5-inch midrail blocking, in doors indicated to have armor plates (HB-6).
   d. 5-inch midrail blocking, in doors indicated to have exit devices (HB-6).

3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges (HB-7).
    a. Screw-Holding Capability: 550 lbf per WDMA TM-10.

G. STC Rated Doors:

1. Core: Composite Sound Core comprising 70 percent of door construction weight with HDF crossbands (20 percent of door construction weight) composed of preconsumer recycled material. 1 3/4 inch finish door thickness. SCL (Structural Composite Lumber), FSC certified, vertical stiles with face matching edge veneers.
2. STC rating: 49 minimum.
3. Fire-rating: 20 minute- positive pressure
4. Face and edge veneers: 'A' grade wood veneer.
    a. Apply to crossbanded core in hot press using Type I, exterior, water-resistant adhesive.
    b. Minimum Thickness Before Sanding: 1/42 inch.
5. Perimeter Gasketing and Drop Seals: See Hardware Schedule, Section 087100.

2.03 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium with Grade A faces.
2. Species: Oak.
3. Cut: Rotary cut.
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
6. Pair and Set Match: Provide for doors hung in same opening.
7. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
8. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in Section 064216 "Flush Wood Paneling."
9. Exposed Vertical and Top Edges: Same species as faces - edge Type A.
10. Core: Either glued wood stave lumber core or structural composite lumber.
11. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.
12. WDMA I.S. 1A Performance Grade: Extra Heavy Duty.

2.04 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species Rotary cut as door faces.
2. Profile: Flush rectangular beads.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Metal Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

1. Anemostat Door Products; WoodPro Wood Veneer FR Metal Vision Frame with no visible fasteners, for 3/16" or 1/4" glazing, Species: White Oak, finish to match door face panels.
2. or approved equal.

C. Metal Vision Light Frames for Fire Rated Doors: 18 and 20 gauge cold rolled steel, Custom Color Baked Enamel finish, Type M4 as per WDMA I.S. 1A as manufactured by one of the following:

1. Anemostat Door Products; LoPro Metal Vision Frames for 1/4" or 5/16" glazing and StormPro-HR Hurricane Rated Metal Vision Frame.
2. or approved equal.

2.05 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA A156.115W, and hardware templates.

1. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. 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 - {\t\#1000142}.
3. Louvers: Factory install louvers in prepared openings.

2.06 FINISHES -WOOD VENEER DOORS

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Factory finish doors that are indicated to receive transparent finish.

D. Factory finish doors where indicated in schedules or on Drawings as factory finished.

E. Transparent Finish:

1. Grade: Premium.
2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 10. UV Curable, Water Based.

3. Finish: WDMA TR-6/OP-6 (Extra Heavy-Duty) catalyzed polyurethane and TR-8, UV cured urethane (Premium Grade).
4. Staining: As selected by Architect from manufacturer's full range.
5. Sealer: minimum 3 coats.
6. Sanding: Sand.
7. Topcoat: 2 coats.
8. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores or as selected by the architect.
9. Sheen: Semi-gloss.

PART 3 - EXECUTION

3.01 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.

3.02 INSTALLATION

A. Hardware: See Section 087100 - {\t\#1000144}.
B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
   1. Install fire-rated doors according to NFPA 80.
C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
   1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide1/4 inch from bottom of door to top of threshold unless otherwise indicated.
D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.03 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

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass / Aluminum composite doors.
B. Aluminum door frames.
C. Door hardware.
D. Glazing.

1.02 REFERENCE STANDARDS

A. AAMA 1304 - Voluntary Specification for Determining Forced Entry Resistance of Side-Hinged Door Systems; 2018.
B. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2018.
D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
F. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.
G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
I. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).
J. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2018).
K. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.
L. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2022.
M. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2017.
N. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems; 2020.
O. ASTM D2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging; 2020.
P. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor; 2013a.

Q. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

R. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

S. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

T. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

U. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

V. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2019c.

W. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2023.

X. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1. 3rd printing as adopted by New York State.

Y. ICC A117.1 (2009) - Accessible and Usable Buildings and Facilities.

Z. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

AA. UL (DIR) - Online Certifications Directory; Current Edition.

BB. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Obtain hardware templates from hardware manufacturer prior to starting fabrication.

1.04 SUBMITTALS

A. See Section 013300 - {\t\#1000041}, for submittal procedures.

B. Product Data: Provide manufacturer's standard details, installation instructions, hardware and anchor recommendations.

C. Shop Drawings: Indicate layout and profiles; include assembly methods.

1. Indicate product components, including hardware reinforcement locations and preparations, accessories, finish colors, patterns, and textures.
2. Indicate wall conditions, door and frame elevations, sections, materials, gages, finishes, location of door hardware by dimension, and details of openings; use same reference numbers indicated on drawings to identify details and openings.

D. Selection Samples: Submit one complete sets of color chips, illustrating manufacturer's available finishes, colors, and textures.

E. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements. Reports shall specifically address conformance of the door assemblies with Section 2603 of the 2020 IBC, paragraph 2603.4.1.7.

F. Certification shall be provided from the Door Manufacturer stating that the door assemblies supplied under this Specification Section are in compliance with Section 2603.4 of the 2020 IBC, paragraph 2603.4.1.7. This Certification shall be an original letter signed by a currently authorized officer of the Door Manufacturer.

G. Manufacturer's Qualification Statement.

H. Manufacturer's Project References: Submit list of successfully completed projects including 0project name and location, name of architect, and type and quantity of doors manufactured.

I. Installer's Qualification Statement.

J. Maintenance Data: Include instructions for repair of minor scratches and damage.

K. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer; include detailed terms of warranty.

L. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016100 - {\t\#1000030}, for additional provisions.
2. Package products with protective coverings and identify with descriptive labels.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than twenty years of documented experience.

1. Door and frame components from same manufacturer.
2. Evidence of a compliant documented quality management system.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Mark doors with location of installation, door type, color, and weight.

B. Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Handling: Protect materials and finish from damage during handling and installation.

D. Deliver pre-assembled doors and frames "floated" with individual recyclable corrugated cartons complete with braces, spreaders, and packaging as required to prevent damage or contact with the corrugated enclosure.

E. Store materials in original packaging, under cover, protected from exposure to harmful weather conditions and from direct contact with water.

1. Store at temperature and humidity conditions recommended by manufacturer.
2. Do not use non-vented plastic or canvas shelters.
3. Immediately remove wet wrappers.

F. Store in position recommended by manufacturer, elevated minimum 4 inch (102 mm) above grade, with minimum 1/4 inch (6.4 mm) space between doors.

1.07 FIELD CONDITIONS

A. Do not install doors until structure is enclosed.

B. Maintain temperature and humidity at manufacturer's recommended levels during and after installation of doors.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide ten (10) year manufacturer warranty covering materials, installation and workmanship including degredation or failure due to chemical contact, failure of corner joinery, core deterioration, and delamination or bubbling of door skin.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fiberglass Composite Doors:

1. Special-Lite, Inc; PO Box 6, Decatur, Michigan 49045. Toll Free (800) 821-6531. Phone (269) 423-7068. Fax (800) 423-7610. Web Site www.special-lite.com. E-Mail: info@special-lite.com.
2. FRP Architectural Doors, Inc.; Bensalem, PA
3. Architect Approved Equivalent.
4. Substitutions: See Section 016100 - Product Requirements and Section 012500 - Substitution Procedures..

2.02 DOOR AND FRAME ASSEMBLIES

A. Door Opening Size: As indicated on the drawings. Contractor is responsible to field verify existing masonry opening sizes and coordinate new FRP door sizes in conjunction with drawings and with the Submittal process.

B. Door and Frame Assemblies: Factory-fabricated, prepared and machined for hardware.

1. Physical Endurance: Swinging door cycle test to ANSI/SDI A250.4, Level A (1,000,000 cycles) minimum; tested with hardware and fasteners intended for use on project.
2. Surface Burning Characteristics: Flame spread index (FSI) of 0 to 25, Class A, and smoke developed index (SDI) of 450 or less, when tested in accordance with ASTM E84.
3. Flammability: Self-extinguishing when tested in accordance with ASTM D635.
4. Clearance Between Door and Frame: 1/8 inch (3 mm), maximum.
5. Clearance Between Bottom of Door and Finished Floor: 3/4 inch (19 mm), maximum; not less than 1/4 inch (6 mm) clearance to threshold.
6. Insulated Foam Cores, Non-rated Swinging Doors: IBC 2603.4.1.7, Passed by independent test or meet code. 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 (0.8mm) aluminum or steel having a base metal thickness of not less than 0.016 inch (0.4 mm) at any point.

2.03 FRP / ALUMINUM COMPOSITE FLUSH DOORS

A. Model: SL-20 (Sandstone Texture) Flush Doors with SpecLite3 fiberglass reinforced polyester (FRP) face sheets.

1. Doors:
   a. Thickness: 1-3/4 inch (44 mm), nominal.
   b. Fiberglass construction with reinforced core.
   c. Core Material: Poured-in-place polyurethane foam with a minimum density of 5 pounds per cubic foot with a corresponding R- Value of 9 minimum.
2. Construction:
   a. Stiles and Rails: Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T6 alloy recovered from industrial processes, minimum of 2-5/16 inch depth.
   b. Corners: Mitered.
   c. Provide joinery of 3/8-inch diameter full-width tie rods through extruded splines top and bottom integral to standard tubular shaped stiles and rails reinforced to accept hardware as specified.
   d. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery. Welds, glue, or other methods are not acceptable.
   e. Furnish extruded stiles and rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.
   f. Doors shall have 0.032 Aluminum metal core liner sheeting installed under the FRP creating a barrier sheet between the core and fiberglass door surface.
   g. Rail caps or other face sheet capture methods are not acceptable.
   h. Extrude top and bottom rail legs for interlocking continuous weather bar.
   i. Meeting Stiles: Pile brush weatherseals. Extruded meeting stile to include integral pocket to accept pile brush weatherseals.
   j. Bottom of Door: Install bottom weather bar with nylon brush weather-stripping into extruded interlocking edge of bottom rail.
   k. Glue: Use of glue to bond sheet to core or extrusions is not acceptable.
3. Face Sheet
   a. Material: SpecLite3 FRP, 0.120-inch thickness, finish color throughout installed over 0.032 aluminum metal sheet.
   b. Protective coating: Abuse-resistant engineered surface. Provide FRP with SpecLite3 protective coating, or equal.
   c. Texture: Sandstone (SL-20).
   d. Color: Contractor shall submit manufacturers complete color chart for color selection(s) to be approved by Architect and Owner prior to fabrication
   e. Adhesion: The use of glue to bond face sheet to foam core is prohibited.
   f. Provide Class A Fire Resistance Rated Interior Face Sheet.
   g. Comply with IBC 2603.4.1.7, passed by independent test or meet code. 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 base metal thickness of 0.032 inch aluminum or steel having a thickness of not less than 0.016 inches at any point.

4. Core:
    a. Material: Poured-in-place polyurethane foam.
    b. Density: Minimum of 5 pounds per cubic foot.
    c. R-Value: Minimum of 9.
5. Cutouts:
    a. Manufacture doors with cutouts for required vision lites, louvers, and panels.
    b. Factory install vision lites, louvers, and insulated panels. Coordinate with Drawings for locations.
6. Subframe and Reinforcements: Manufacturer's standard materials.
7. Waterproof Integrity: Provide factory fabricated edges, cut-outs, and hardware preparations of fiberglass reinforced plastic (FRP); provide cut-outs with joints sealed independently of glazing, louver inserts, or trim.
8. Hardware Preparations: Factory reinforce, machine, and prepare for door hardware including field installed items; provide solid blocking for each item; field cutting, drilling or tapping is not permitted; obtain manufacturer's hardware templates for preparation as necessary.
9. Bottom Rail: Provide height necessary to allow up to 1-1/4 inch (31.8 mm) field cut off bottom of door without impairing door strength or durability.
10. Fabrication:
    a. Sizes and Profiles: Required sizes for door and frame units shall be as indicated on the Drawings.
    b. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on coordinated shop drawings for review.
    c. Welding: Welding of doors or frames is not acceptable.
    d. Fit:
        1) Maintain continuity of line and accurate relation of planes and angles.
        2) Secure attachments and support at mechanical joints with hairline fit at contacting members.
        3) All screws and bolts used for attachment shall be non-ferrous and concealed from the building exterior. No screws or bolts shall be visible on doors, or on exterior surfaces of the frames. Provide concealed fastenings for framework connections.
        4) Provide and install all miscellaneous trim and closures.
11. Hardware:
    a. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
    b. Factory install hardware.
    c. Construction Keying: Coordinate all keying with School District Representative. The General Contractor shall provide temporary construction cores in all the new locksets. Prior to job completion the contractor shall coordinate shipment of permanent masterkeyed cores directly to the District. Upon completion of contract work, the District shall replace the temporary construction cores with the masterkeyed cores and return the construction cores to the contractor for return to the manufacturer. All masterkeyed cores, new keys (2 per lockset) and all services required from the manufacturer, including shipping and handling of masterkeyed cores to the District and return of temporary construction cores to manufacturer, shall be paid by the General Contractor. All masterkeying shall be as manufactured by Best.
    d. Hardware Schedule: As noted in "HARDWARE" article in this Section
    e. Door Handing: As per Contract drawings, indicate on shop drawings.

12. Vision Lites: Provide door panels with 1” insulated clear safety vision lites where indicated on contract drawings. Provide shop drawings for review.

B. Door Frames: Provide type in compliance with performance requirements specified for doors.

1. Aluminum profiles: As indicated on drawings.
2. Non-Fire-Rated:
   a. Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T6 alloy recovered from industrial processes: ASTM B221. Aluminum, 0.04 inch (1.0 mm) minimum wall thickness; natural anodized finish.
   b. Sheet and Plate: ASTM B209.
   c. Alloy and Temper: As required by manufacturer for strength, corrosion resistance, application of required finish, and control of color.
3. Components: Door and frame components from same manufacturer.
4. Fasteners:
   a. Material: Aluminum, 18-8 stainless steel, or other noncorrosive metal.
   b. Compatibility: Compatible with items to be fastened.
5. Fire-Rated: Provide frames bearing labels to match doors.
   a. Galvanized steel, hot-dipped to ASTM A653/A653M with Designation G185/Z550 coating or ASTM A123/A123M with Grade 80 coating; 18 gage, 0.05 inch (1.2 mm) minimum thickness; degreased and primed for field painting.
6. Frame Anchors: Stainless steel, Type 304; provide three anchors in each jamb for heights up to 84 inches (2130 mm) with one additional anchor for each additional 24 inches (610 mm) in height.
7. Reinforcing: Provide manufacturer's standard reinforcing at hinge, strike, and closer locations.

2.04 ALUMINUM DOOR FRAMING SYSTEMS

A. Tubular Framing:

1. Size and Type: As indicated on the Drawings.
2. Materials: Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T6 alloy recovered from industrial processes, 1/8-inch minimum wall thickness.
3. Applied Door Stops: 0.625-inch high, with screws and weatherstripping. Door stop shall incorporate pressure gasketing for weathering seal. Counterpunch fastener holes in door stop to preserve full metal thickness under fastener head.
4. Frame Members: Box type with 4 enclosed sides. Open-back framing is not acceptable.
5. Caulking: Caulk joints before assembling frame members.
6. Joints:
   a. Secure joints with fasteners.
   b. Provide hairline butt joint appearance.
7. Field Fabrication: Field fabrication of framing using stick material is not acceptable.
8. Applied Stops: For side, transom, and borrowed lites and panels. Applied stops shall incorporate pressure gasketing for weathering seal. Reinforce with solid bar stock fill for frame hardware attachments.
9. Hardware:
   a. Premachine and reinforce frame members for hardware in accordance with manufacturer's standards and hardware schedule.
   b. Factory install hardware.
10. 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, side lites, and similar conditions.

11. Side Lites:
    a. Factory preassemble side lites to greatest extent possible.
    b. Mark frame assemblies according to location.

2.05 HARDWARE

A. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.

B. Factory install hardware. See Hardware Section 087100.

1. Hinges: SL-11HD continuous hinges or as specified in Section 087100.
2. Door Pulls: SL-82.
3. Exit Devices: See Hardware Section 087100.
4. Closers: See Section 087100.
5. Thresholds: Aluminum, with skid resistant surface, extends full width of door opening, 1/2 inch (12.7 mm) high by 6 inch (152 mm) wide; same color as frame. Cope to frame profile. Set toes in sealant.
6. Concealed adjustable bottom brush. Install door manufacturer's multi-directional adjustable bottom with double nylon brush weatherstripping. Door bottom must be concealed and adjust to accommodate irregular tapered floor conditions.
7. Concealed adjustable meeting stile astragal. Install door manufacturer's adjustable astragal with double pile and weather seal weatherstripping.
8. Finish: Clear Anodized.

2.06 VISION LITES

A. Factory Glazing: 1-inch Tempered Insulating Glass..

B. Lites in Exterior Doors: Allow for thermal expansion.

C. Rectangular Lites:

1. Size: As indicated on the drawings.
2. Factory glazed with screw-applied aluminum stops anodized to match perimeter door rails.

D. Security Grate: SL-SG349.

1. Frame Perimeter: 1-inch by 1-inch by 1/8-inch steel angle.
2. Expanded Metal: 1/4-inch diameter, round hole perforated, 14-gauge steel sheet.
3. Finish: Factory painted to match door finish.

E. Vandal Screen: SL-SG350.

1. Frame Perimeter: Aluminum. Finish to match vision lite.
2. Expanded Metal: 1/4-inch diameter, round hole perforated, 16-gauge stainless steel sheet. Powder coat black finish.

2.07 ARCHITECTURAL FIBERGLASS REINFORCED POLYESTER (FRP) PANELS

A. FRP PANELS:

1. Model: SL-30 Sandstone-Textured Insulated Architectural Panels with SpecLite3® FRP face sheets.
2. Thickness: 1 3/4 inch (R 10) or as indicated on the Drawings.

B. Face Sheets:
   1. Material: SpecLite3 FRP, 0.120 inch (SL-37) thickness, finish color throughout. Abuse-resistant engineered surface.
   2. Texture: Sandstone
   3. Color: Standard as selected by the Architect and Owner from Manufacturer's standard color chart with the submittal process.

C. Insulated Speclite3 FRP Panels:
   1. Insulated Panels: Two 0.120-inch minimum thickness sheets.
   2. Core: Foam polyurethane core of a minimum of 5 pounds per cubic foot density.
   3. CRF: Minimum of 81 for 1" inch panels.
   4. Form components to function as single unit.
   5. Class A flame spread and smoke developed rating on interior faces of exterior panels and both faces of interior panels.
   6. Flame Spread, ASTM E84: Maximum of 25.
   7. Smoke Developed, ASTM E84: Maximum of 450.

2.08 PERFORMANCE REQUIREMENTS

A. Provide door assemblies that have been designed and fabricated in compliance with specified performance requirements.

B. Surface Burning Characteristics, Class A Option On Interior Faces of FRP Exterior Panels and Both Faces of FRP Interior Panels, ASTM E84:
   1. Flame Spread: Maximum of 25.
   2. Smoke Developed: Maximum of 450.

C. Stain Resistance, ASTM D1308: Face sheet unaffected after exposure to red cabbage, tea, and tomato acid. Stain removed easily with mild abrasive or FRP cleaner when exposed to crayon and crankcase oil

D. Forced Entry Resistance: Pass in accordance with AAMA 1304 test method.

E. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 7.5 psf (359 Pa).

F. Air Leakage: Maximum of 0.1 cu ft/min/sq ft at 6.27 psf (0.5 L/sec/sq m at 300 Pa) differential pressure, when tested in accordance with ASTM E283. Door shall not exceed 0.58 cfm/ft2.

G. Indoor air quality testing per ASTM D 6670: GREENGUARD Environmental Institute Certified including GREENGUARD for Children and Schools Certification.

H. Structural Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.

I. Hurricane Test Standards, Single Door:
   1. Uniform Static Load, ASTM E330/E330M: Plus or minus 195 pounds per square foot.
   2. Forced Entry Test, 300 Pound Load Applied, SFBC 3603.2 (b)(5): Passed.
   3. Cyclic Load Test, SFBC PA 203: Plus or minus 53 pounds per square foot.
   4. Large Missile Impact Test, SFBC PA 201: Passed.

J. Thermal Transmittance, Exterior Doors: AAMA 1503, U-value of 0.29, maximum, measured on exterior door in size required for this project. Minimum of 55 CRF value.

K. Thermal and Humid Aging, Foam Core, Nominal Value, 158 Degrees F and 100 Percent Humidity for 14 Days, ASTM D2126 : Minus 5.14 percent volume change.

L. Acoustical Performance: Sound Transmission Class (STC) of 25, minimum, when tested in accordance with ASTM E90.

M. Fiberglass Reinforced Plastic (FRP) Face Sheet Properties:

1. Izod Impact Resistance: ASTM D256, 14 ft lbf/inch of width, minimum, with notched izod.
2. Tensile Strength at Break: ASTM D638, 12,000 psi, minimum.
3. Water Absorption: ASTM D570,.20 percent, maximum, after 24 hours at 74 degrees F (23 degrees C).
4. Flexural Strength: ASTM D790, 21,000 psi, minimum.
5. Barcol Hardness: ASTM D2583, minimum of 55 units.

N. Gardner Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 5420: 120 in-lb.

O. Abrasion Resistance, Face Sheet, Taber Abrasion Test, 25 Cycles at 1,000 Gram Weight with CS-17 Wheel: Maximum of 0.029 average weight loss percentage.

P. Salt Spray, Exterior Doors and Frames, ASTM B117: Minimum of 500 hours.

Q. Swinging Door Cycle Test, Doors and Frames, ANSI A250.4: Minimum of 25,000,000 cycles.

R. Cycle Slam Test Method, NWWDA T.M. 7-90: Minimum 5,000,000 Cycles

S. Swinging Security Door Assembly, Doors and Frames, ASTM F476: Grade 40.

2.09 ACCESSORIES

A. Stops for Glazing and Louver: Fiberglass, unless otherwise indicated or required by fire rating; provided by door manufacturer to fit factory made openings, with color and texture to match door; fasteners shall maintain waterproof integrity.

1. Exterior Doors: Provide non-removable stops on exterior side with continuous compression gasket weatherseal.
2. Glazed Openings: Provide removable stops on interior side.
3. Fire-Rated Doors: Provide stop kit listed by labeling authority.
4. Opening Sizes and Shapes: As indicated on drawings.

B. Glazing:

1. Laminated safety glass, 1/4 inch (6 mm) thick, with minimum 0.030 inch (0.76 mm) thick interlayer, clear.

2.10 ALUMINUM FINISHES

A. Anodized Finish: Class I finish, 0.7 mils thick.

1. Clear 215 R1, AA-M10C12C22A41, Class I, 0.7 mils thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify actual dimensions of openings by field measurements before door fabrication; show recorded measurements on shop drawings.

B. Do not begin installation until substrates have been properly prepared. Ensure openings to receive frames are plumb, level, square, and in tolerance.

C. If substrate preparation is the responsibility of another installer, notify Architect/Engineer of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. Clean and prepare substrate in accordance with manufacturer's directions.

1. Protect adjacent work and finish surfaces from damage during installation.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions; do not penetrate frames with anchors.

B. Install exterior doors in accordance with ASTM E2112.

C. Install door hardware as specified in Section(s) 080671 and 087100.

D. Set units plumb, level, and true-to-line, without warping or racking doors, and with specified clearances; anchor in place.

E. Set thresholds in continuous bed of sealant.

F. In masonry walls, install frames prior to laying masonry; anchor frames into masonry mortar joints; fill jambs with grout as walls are laid up.

G. Separate aluminum and other metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials.

H. Repair or replace damaged installed products.

3.04 ADJUSTING

A. Lubricate, test, and adjust doors to operate easily, free from warp, twist or distortion, and to fit watertight for entire perimeter.

B. Adjust hardware for smooth and quiet operation.

C. Adjust doors to fit snugly and close without sticking or binding.

3.05 CLEANING

A. Clean installed products in accordance with manufacturer’s instructions prior to owner’s acceptance.

B. Do not use harsh cleaning materials or methods that would damage finish.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Fire-resistive rated access door and frame units for wall and ceilings.

1.03 REFERENCES

A. ASTM E 152 - Standard Methods of Fire Tests of Door Assemblies

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

E. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

F. NFPA 288 - Standard Methods of Fire Tests of Horizontal Fire Door Assemblies Installed in Horizontal Fire Resistance-Rated Assemblies; 2022.

G. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Section 013300 - SUBMITTALS: Procedure for submittals.

B. Shop drawings: Fully describe and locate all items being furnished and include large scale details of principal construction features and internal reinforcement. Indicate dimensions, elevations, hardware, reinforcement, anchor types and spacing, and finishes.

C. Product Data: Indicate door and frame configuration and finishes with manufacturer's standard details and catalog data demonstrating compliance with referenced standards

D. Samples: For each door face material, at least 3 by 5 inches (75 by 125 mm) in size, in specified finish.

E. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.05 QUALITY ASSURANCE

A. Manufacturer: Minimum five years documented experience producing products specified in this section.

B. Installer: Minimum five years documented experience installing products specified in this section.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
   2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.02 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
   1. Acudor Products, Inc.
   2. Best Access Doors.
   3. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
   4. Karp Associates, Inc.
   5. Milcor Inc.
   6. Nystrom, Inc.

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors with Exposed Flanges:
   1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
   2. Locations: Wall and ceiling.
   3. Metallic-Coated Steel Sheet for Door: 0.070 inch, 14 gauge steel sheet thickness for Fire-rated access doors and 20 gauge (0.0359 inch) single thickness steel sheet for non-fire rated access doors.
      a. Finish: Factory prime
   4. Hinges: 175 degree stainless steel piano hinge concealed constant force closure spring type.
   5. Hardware: Self latching, key operated.

D. Flush Access Doors with Concealed Flanges:
   1. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
   2. Locations: Wall and ceiling .
   3. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage
      a. Finish: Factory prime.

E. Fire-Rated, Flush Access Doors with Concealed Flanges
   1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide frame with gypsum board beads for concealed flange installation.
   2. Locations: Wall and ceiling.

3. Fire-Resistance Rating: Not less than that of adjacent construction.
4. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch (1.02 mm), 20 gage.
   a. Finish: Factory prime.

F. Hardware:

1. Latch: Self-latching bolt operated by flush key with interior release or as indicated for each door.

G. Locks:

1. Cylinder locks keyed alike for each door panel. Provide 2 keys per access panel. Coordinate locks and keying with the Owner's requirements and existing keying system(s) where applicable.

2.03 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Stainless Steel: Type 304, brushed #4 finish.

C. Frame Anchors: Same type as door face.

D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F 2329. At stainless steel doors, provide stainless steel fasteners.

2.04 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
2. Provide mounting holes in frames for attachment of units to metal or wood framing.
3. Provide mounting holes in frame for attachment of masonry anchors.

2.05 FINISHES

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: 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.

D. Steel and Metallic-Coated-Steel Finishes:

1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Verify that field measurements, surfaces, substrates and project conditions are as required and suitable for installation. Verify that rough openings for door and frame are correctly sized and located. Do not proceed with installation until unsatisfactory conditions have been corrected.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

D. Secure rigidly in place.

E. Position unit to provide convenient access to concealed work requiring access.

3.03 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Exterior and Interior storefront framing.
   2. Exterior and Interior manual-swing entrance doors and door-frame units.

1.03 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.04 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
   1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
   2. Dimensional tolerances of building frame and other adjacent construction.
   3. Failure includes the following:
      a. Deflection exceeding specified limits.
      b. Thermal stresses transferring to building structure.
      c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
      d. Noise or vibration created by wind and by thermal and structural movements.
      e. Loosening or weakening of fasteners, attachments, and other components.
      f. Sealant failure.
      g. Failure of operating units.

B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Loads:
   1. Wind Loads:
      a. Basic Wind Speed: 130 mph.
      b. Importance Factor: II
      c. Exposure Category: D

D. Deflection of Framing Members:
   1. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch, whichever is smaller.

E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E330/E330M as follows:
   1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

F. Windborne-Debris-Impact-Resistance Performance: Provide aluminum-framed systems that pass missile-impact and cyclic-pressure tests when tested according to ASTM E1886 and testing information in ASTM E1996.
   1. Large-Missile Impact: For aluminum-framed systems located within 30 feet of grade.
   2. Small-Missile Impact: For aluminum-framed systems located more than 30 feet above grade.
   3. Test Performance: Meet criteria for passing, based on building occupancy type, when tested according to AAMA 501.4 at design displacement and 1.5 times design displacement.

G. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. For single-acting offset pivot or butt-hung entrances in the closed and locked position, the test specimen shall be tested in accordance with ASTM E283/E283M at a pressure differential of 1.57 psf for single doors and pairs of doors. A pair of 6'-0" x 7'-0" entrance doors and frame shall not exceed 1.0 cfm per square foot. A single 3'-0" x 7'-0" entrance door and frame shall not exceed 1.0 cfm/ft2.

H. Blast Mitigation Performance: Shall be tested or proven through analysis to meet ASTM F1642, GSA TS01, and UFC 4-010-01 performance criteria.
   1. To meet UFC 4-010-01, B-3.3 Standard 12 for exterior doors and Standard 10 for glazing and frame bite provisions, the following options are available:
      a. Section B-3.1.1: Dynamic analysis
      b. Section B-3.1.2: Testing
      c. Section B-3.1.3: ASTM F2248 Design Approach

I. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft.

J. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
   1. Maximum Water Leakage: No uncontrolled water penetrating aluminum-framed systems or water appearing on systems normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.

K. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
   2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
      a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
      b. Low Exterior Ambient-Air Temperature: 0 deg F.
   3. Interior Ambient-Air Temperature: 75 deg F.

L. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 49 frame and 68 glass (Low E) when tested according to AAMA 1503.

M. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having a system U-factor of not more than 0.38 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

N. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having the following sound-transmission characteristics:
   1. Sound Transmission Class (STC): Minimum 37 STC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.
   2. Outdoor-Indoor Transmission Class (OITC): Minimum 32 OITC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E1332.

O. Material Ingredient Reporting: Shall have a complete list of chemical ingredients to at least 100ppm (0.01%) that covers 100% of the product, acceptable documentation includes:
   1. Manufacturer's inventory with Chemical Abstract Service Registration Number (CASRN or CAS#).
      a. Kawneer's Material Transparency Summary (MTS).
   2. Cradle to Cradle certification: Either document below is acceptable for this option.
      a. Cradle to Cradle Certified™ with Material Health section Silver or above.
      b. Silver level or above Material Health Certificate.
   3. Red List Free DECLARE label.
   4. Environmental Product Declaration (EPD): Shall have a Type III Product-Specific EPD created from a Product Category Rule.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Testing Agency Qualifications: Qualified according to ASTM E699 for testing indicated.

C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

1. Shop Drawings: Drawings showing layout, dimensions, identification of components, and interface with adjacent construction.
   a. Include field measurements of openings.
   b. Include elevations showing:
      1) Appearance of Aluminum-framed system layouts.
      2) Locations and identification of manufacturer-supplied door hardware and fittings.
      3) Locations and sizes of cut-outs and drilled holes for other door hardware.
   c. Include details of:
      1) Requirements for support and bracing at openings.
      2) Installation details.
      3) Appearance of manufacturer-supplied door hardware and fittings.
   d. Schedule: Listing of each type component in Aluminum-framed system assemblies, cross-referenced to shop drawing plans, elevations, and details.

D. Product Options: Information on Drawings and in Specifications establishes requirements for systems aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines ICC A117.1.

F. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

G. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection.

b. Noise or vibration caused by thermal movements.
c. Water leakage through fixed glazing and framing areas.
d. Failure of operating components.

2. Warranty Period: Five Years (Class I Anodized) from date of Substantial Completion.

B. Special Finish Warranty AAMA 2605 : Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Substantial Completion.

1.09 MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Kawneer North America
2. Trifab® VersaGlaze® 451 Framing System
   a. 2" x 4-1/2" (50.8 mm x 114.3 mm) nominal dimension
3. Non-thermal

B. Front, center, back, multi-plane, structural silicone or weatherseal (type B) glazed

1. Screw spline, shear block, stick, or punched opening

C. Architect approved equivalent.

2.02 MATERIALS

A. Aluminum: 6063-T6 Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
3. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
4. Structural Profiles: ASTM B308/B308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment.

Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

C. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

D. Recycled Content:

1. Shall have a minimum of 50% mixed pre- and post-consumer recycled content.
2. Indicate recycled content, including the percentage of pre- and post-consumer recycled content per unit of product.
3. Indicate the relative dollar value of recycled content product to the total dollar value of product included in the project.
4. Indicate the location for recovery of recycled content.
5. Indicate the location of the manufacturing facility.

E. Red List Free:

1. All parts and materials comply with the Living Building Challenge/DECLARE Red List and the Cradle-to-Cradle (C2C) Banned List:
   a. PVC-free
   b. Neoprene-free
2. Product does not contain PVC or Neoprene.

2.03 STOREFRONT FRAMING SYSTEMS

A. Framing System Description:

1. Kawneer North America: TriFab 451UT Framing System (Basis of Design)
2. YKK AP America Inc.: YES 45 TU
3. EFCO Corporation.

B. Aluminum Extrusions: ASTM B221, 6063-T6 alloy and temper or as recommended by aluminum-framed door and storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" wall thickness at any location for the main frame and door leaf members.

1. Construction: Thermally broken.
   a. Kawneer IsoLock® Thermal Break with dual nominal 1/4" (6.4 mm) separation consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.
   b. Thermal break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Multipane.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Where exposed, fasteners and accessories shall be stainless steel.

F. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, non-bleeding flashing compatible with adjacent materials.

G. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

1. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.04 GLAZING SYSTEMS

A. Glazing: As specified in Section 088000 - GLAZING

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal, Extruded EPDM rubber.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape:

1. Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:

1. Weatherseal Sealant: ASTM C920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
2. Structural Sealant: ASTM C1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
   a. Color: Black matching structural sealant.

2.05 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 2 1/4 inches (Insulclad 260, 360 and 560) overall thickness, with minimum 0.125-inch thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: 350T Insulpour; 3 1/2 inch vertical face.

a. Top Rail: 3 1/2 inch (Insulpour 350T).
b. Bottom Rail: 10 inches (optional)
1) Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.

3. Thermal Barrier:
a. Shall be IsoPour™ utilizing two continuous rows of polypropylene with a nominal 7/32" (5.5 mm) separation that consists of a two-part, chemically curing high density polyurethane which is mechanically and adhesively bonded to the aluminum at door rails and stiles.
4. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops, 0.05 inch (1.3 mm) thick and preformed gaskets of EPDM elastomeric extrusions or a thermoplastic elastomer.
5. Provide adjustable glass jacks to help center the glass in the door opening.
6. Slide-In-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
a. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

2.06 ENTRANCE DOOR HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum-framed entrance doors. Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section. Adjust hardware to accommodate security and access control applications accordingly.
1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products. See Section 087100 - DOOR HARDWARE for detail Hardware information.
2. Opening-Force Requirements:
a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
b. Accessible Interior Doors: Not more than 5 lbf to fully open door.

B. Opening-Force Requirements:
1. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force of not more than 15 lbf for not more than 3 seconds.
2. Latches and Exit Devices: Not more than 15 lbf required to release latch.

C. Pivot Hinges: BHMA A156.4, Grade 1.

D. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Cylinders: As specified in Section 087100 - DOOR HARDWARE.
1. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE".

F. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

G. Operating Trim: BHMA A156.6.

H. Concealed Overhead Holders: BHMA A156.8, Grade 1.

I. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

J. Weather Stripping: Manufacturer's standard replaceable components.

1. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing with polymeric fin.
2. Meeting stiles on pairs of doors shall be equipped with two lines of weather-stripping utilizing wool pile with polymeric fin.
3. The door weathering on a single acting offset pivot or butt hung door and frame (single or pairs) shall be comprised of a thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing and a wool pile with polymeric fin.

K. Weather Sweeps: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners

L. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1v:2h, with maximum height of 1/2 inch. Thermally broken, with ribbed slip-resistant surface.

M. Electric Strike / Strike Keeper: BHMA A156.31

2.07 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 079200 - JOINT SEALANTS.

B. Adjustable Aluminum Mullion/Partition Closures: MULLION MATE – SERIES 40 PLUS extruded aluminum partition closure shall be manufactured by Gordon Interior Specialties Division, Gordon, Inc., 5023 Hazel Jones Road, Bossier City, LA 71111, (800) 747-8954, Fax (800) 877-8746, sales@gordoninteriors.com or approved equal.

1. Aluminum extrusions: 6063-T5 temper, tensile strength 31 KSI, ASTM B221.
   a. Size(s): Mullion Mate 3: 2 7/8 inch through 3 15/16 inch, Mullion Mate 4: 4 inch through 4 15/16 inch, Mullion Mate 5: 5 inch through 6 15/16 inch, Mullion Mate 7: 7 inch through 9 3/4 inch, and Mullion Mate 9: 9 inch through 13 3/4 inch or as required by the field conditions.
   b. Length: 10 foot or as required by field conditions.
   c. Finish: Acrylic-Polyester hybrid powder-coat paint finish in color as selected by the Architect from the manufacturer's full color offering.

2.08 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate thermally broken aluminum-framed entrance doors in sizes indicated. Include a complete system for assembling components and anchoring doors.

C. Fabricate thermally broken aluminum-framed doors that are reglazable without dismantling perimeter framing.

D. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered. Make joints hairline in appearance
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
8. Prepare components with internal reinforcement for door hardware.

E. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.09 ALUMINUM FINISHES

A. Finish designations that are prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:

1. Kawneer Permafluor™ (70% PVDF), AAMA 2605, Fluoropolymer Coating. Color:_As selected by the Architect from the manufacturer's full color offering.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

3.03 INSTALLATION

A. General:

1. Install curtain wall systems plumb, level, and true to line, without warp or rack of frames, within manufacturer’s prescribed tolerances, and complying with installation instructions.
2. Provide support and anchor in place.
3. Do not install damaged components.
4. Fit joints to produce hairline joints free of burrs and distortion.
5. Rigidly secure non-movement joints.
6. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
7. Seal joints watertight unless otherwise indicated.

B. Glazing:

1. Glass shall be outside-glazed.
2. Glass shall be held in place with extruded aluminum pressure plates anchored to the mullion using stainless steel fasteners that are spaced no more than 9" (228.6 mm) on center.
3. Install glazing as specified in Section 088000 - GLAZING.
4. References: ANSI Z97.1, CPSC 16 CFR 1201, and GANA Glazing Manual.

C. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing non-conductive spacers as recommended by manufacturer for this purpose.

2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

D. Water Drainage

1. Each light of glass shall be compartmentalized using joint plugs and silicone sealant to divert water to the horizontal weep locations.
2. Weep holes shall be located in the horizontal pressure plates and covers to divert water to the exterior of the building.

E. Install perimeter joint sealants as specified in Section 079200 - JOINT SEALANTS to produce weathertight installation.

3.04 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment:
   a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
   b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.05 FIELD QUALITY CONTROL

A. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive phases as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under "Performance Requirements" Article, but not more than 0.09 cfm / sq. ft. of fixed wall area when tested according to ASTM E283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft.
2. Water Infiltration: Conduct tests in accordance with ASTM E1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 8 psf.

B. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

E. Manufacturer's Field Services:

1. Upon owner’s written request, provide periodic site visit by manufacturer’s field service representative.

F. Prepare test and inspection reports.

3.06 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
   1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

3.07 CLEANING AND PROTECTION

A. Protect installed product’s finish surfaces from damage during construction.

B. Protect aluminum curtain wall system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

C. Clean aluminum surfaces immediately after installing aluminum-framed door, curtain walls and storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

D. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove non-permanent labels, and clean surfaces.

E. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

F. Remove construction debris from project site and legally dispose of debris

END OF SECTION

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PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section covers Kawneer Architectural Aluminum Curtain Wall Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of curtain wall framing.

B. Types of Kawneer Aluminum Curtain Wall Systems include:

1. 1600 Wall System®1 Curtain Wall:
    a. Sight line: 2-1/2" 2.5 inch (63.5 mm)
    b. Outside-glazed pressure plate format
    c. System depth: 6" 6 inch (152.4 mm)for 1" (1 inch (25.4 mm)) insulating glazing and 1/4" (0.25 inch (6.3 mm)) monolithic glazing

C. Related Sections:

1. 072700: Air Barriers
2. 079200: Joint Sealants
3. 084113: Aluminum-Framed Entrances and Storefronts
4. 088000: Glazing

1.03 DEFINITIONS

A. For fenestration industry standard terminology and definitions, refer to the Fenestration & Glazing Industry Alliance (FGIA) Glossary (AAMA AG-13).

1.04 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure; 2017.

C. AAMA 501.4 - Recommended Static Test Method for Evaluating Window Wall, Curtain Wall and Storefront Systems Subjected to Seismic and Wind-Induced Inter-Story Drift; 2018.

D. AAMA 501.6 - Recommended Dynamic Test Method for Determining the Seismic Drift Causing Glass Fallout from Window Wall, Curtain Wall and Storefront Systems; 2018.

E. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2014.

F. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

G. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2020, with Errata (2022).

H. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

J. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2017 (Reapproved 2022).

K. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.

L. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

M. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

N. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

O. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).

P. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.

Q. ASTM E1425 - Standard Practice for Determining the Acoustical Performance of Windows, Doors, Skylight, and Glazed Wall Systems; 2014 (Reapproved 2023).

R. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials; 2019.

S. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2020.

T. ASTM F2248 - Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass; 2019.

U. GSA TS01 - Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings; General Services Administration; 2003.

V. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2020.

1.05 PERFORMANCE REQUIREMENTS

A. General Performance:

1. Product to comply with the specified performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction, as determined by testing of glazed aluminum curtain walls representing those indicated for this project.

2. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
3. Failure includes any of these events:
   a. Thermal stresses transferring to building structure
   b. Glass breakage
   c. Loosening or weakening of fasteners, attachments, and other components
   d. Failure of operating units

B. Delegated Design:

1. Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Wind Loads:

1. The curtain wall system shall include anchorage that is capable of withstanding the following wind load design pressures:
   a. Inward: (_____) psf or (_____) Pa
   b. Outward: (_____) psf or (_____) Pa
2. The design pressures are based on the (_____) Building Code, (_____) Edition.

D. Air Leakage:

1. The test specimen shall be tested in accordance with ASTM E 283.
2. Air infiltration rate shall not exceed 0.06 cfm/ft2 (0.3 l/s · m2) at a static air pressure differential of 6.2 psf (300 Pa).

E. Water Resistance:

1. Static:
   a. The test specimen shall be tested in accordance with ASTM E331.
   b. There shall be no leakage at a minimum static air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.
2. Dynamic:
   a. The test specimen shall be tested in accordance with AAMA 501.1.
   b. There shall be no leakage at an air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.

F. Uniform Load:

1. A a static air design load of 40 psf (1915 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330.
2. There shall be no deflection in excess of L/175 of the span of any framing member at design load.
3. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

G. Seismic:

1. When tested to AAMA 501.4, system must meet design displacement (elastic) of 0.010 times the story height and ultimate displacement (inelastic) of 1.5 times the design displacement.
2. When tested to AAMA 501.6, system must meet dynamic seismic drift causing glass fallout (ΔFallout) of 4.75" or 0.0300 times the story height.

H. Thermal Transmittance (U-factor), Physical Test:

1. Thermal transmittance test results in accordance with AAMA 1503 or CSA A440 are based upon 1" 1 inch (25.4 mm) clear insulating glass (1/4", 1/2" AS, 1/4").

2. When tested using AAMA 1503, the thermal transmittance (U-factor) shall not be more than 0.66 Btu/hr/(hr·ft2·°F).

I. Thermal Transmittance (U-factor), Physical Test:

1. Thermal transmittance test results in accordance with AAMA 1503 or CSA A440 are based upon 1" 1 inch (25.4 mm) clear, low-emissivity coated glass insulating unit, (1/4" e=0.035, #2), 1/2" warm edge spacer and argon fill gas, 1/4").
2. When tested using AAMA 1503, the thermal transmittance (U-factor) shall not be more than 0.43 Btu/(hr·ft2·°F).

J. Thermal Transmittance (U-factor), Simulation:

1. Thermal transmittance simulation results using NFRC 100 or AAMA 507 are based on a Center of Glass (COG) U-factor of 0.24 Btu/(hr·ft2·°F) and a warm-edge spacer.
2. When simulated using NFRC 100 or AAMA 507, the U-factor shall not be more than 0.39 Btu/(hr·ft2·°F) or project specific (____) Btu/(hr·ft2·°F) per AAMA 507 or (____) Btu/(hr·ft2·°F) per NFRC 100.Condensation Resistance Factor (CRF) or Temperature Index (TI):
3. Condensation resistance test results in accordance with AAMA 1503 or CSA A440 are based upon 1" 1 inch (25.4 mm) clear insulating glass (1/4", 1/2" AS, 1/4").
4. If using CRF: When tested using AAMA 1503, the CRFframe and CRFglass shall not be less than 66 and 60 respectively.
5. If using TI: When tested to CSA A440-00, the TIframe and TIglass shall not be less than 68 and 54 respectively.

K. Condensation Resistance Factor (CRF) or Temperature Index (TI):

1. Condensation resistance test results in accordance with AAMA 1503 or CSA A440 are based upon 1" 1 inch (25.4 mm) clear low emissivity coated insulating glass, (1/4" e=0.035, #2), 1/2" warm edge spacer and argon fill gas, 1/4").
2. When tested using AAMA 1503, the CRFframe and CRFglass (with low-emissivity glazing) shall not be less than 71 and 71 respectively.

L. Sound Transmission Loss:

1. When tested to ASTM E90 and ASTM E1425, the Sound Transmission Class (STC) and Outdoor/Indoor Transmission Class (OITC) shall not be less than:
   a. STC 31 or OITC 26 based upon 1" 1 inch (25.4 mm) insulating glass (1/4", 1/2" AS, 1/4")
   b. STC 37 or OITC 30 based upon 1" 1 inch (25.4 mm) laminated glass (1/4" laminated, 1/2" AS, 1/4" laminated)

M. Windborne-Debris-Impact Resistance Performance:

1. Performance shall be tested in accordance with TAS 201/203, ASTM E1886 and information in ASTM E1996:
   a. Large-Missile Impact: For aluminum-framed systems located within 30 feet (914.4 cm) of grade
   b. Small-Missile Impact: For aluminum-framed systems located above 30 feet (914.4 cm) of grade

N. Blast Mitigation Performance:

1. Performance shall be tested or proven through analysis to meet ASTM F1642, GSA TS01, and UFC 04-010.01 performance criteria.
2. The following options are available to meet UFC 04-010-01, B-3.1 Standard 10 for Windows and Skylights:

a. Section B-3.1.1 Dynamic analysis
b. Section B-3.1.2 Testing
c. Section B-3.1.3 ASTM F2248 Design Approach

O. Environmental Product Declaration (EPD): Shall have a Type III Product-Specific EPD created from a Product Category Rule.

P. Material Ingredient Reporting:
1. Shall have a complete list of chemical ingredients to at least 100 ppm (0.01%) that covers 100% of the product.
2. Acceptable documentation includes:
a. Manufacturer's inventory with Chemical Abstract Service Registration Number (CASRN or CAS#):
1) Kawneer's Material Transparency Summary (MTS)
b. Cradle to Cradle certification; either document listed below is acceptable for this option:
1) Cradle to Cradle Certified™ with Material Health section Silver or higher
2) Silver Level or higher Material Health Certificate
c. Red List Free DECLARE label

1.06 SUBMITTALS

A. Product Data:
1. For each type of product indicated, include:
a. Construction details
b. Material descriptions
c. Dimensions of individual components and profiles
d. Finishes
2. Recycled Content:
a. Provide documentation that aluminum has a minimum of 50% mixed pre- and post-consumer recycled content.
b. Provide a sample document illustrating project-specific information that will be provided after product shipment.
c. After product has shipped, provide project-specific recycled content information:
1) Indicate recycled content, including the percentage of pre- and post-consumer recycled content per unit of product.
2) Indicate the relative dollar value of recycled content product to the total dollar value of product included in the project.
3) Indicate the location for recovery of recycled content.
4) Indicate the location of the manufacturing facility.
5) Environmental Product Declaration (EPD):
d. Include a Type III Product-Specific EPD created from a Product Category Rule.
3. Material Ingredient Reporting:
a. Include documentation for material reporting that has a complete list of chemical ingredients to at least 100 ppm (0.01%) that covers 100% of the product.

B. Shop Drawings:
1. Plans
2. Elevations
3. Sections
4. Full-size details
5. Attachments to other work

C. Samples for Initial Selection:

1. Provide samples for units with factory-applied color finishes.

D. Samples for Verification:

1. Provide a verification sample for each type of exposed finish required, in manufacturer's standard sizes.

E. Product Test Reports:

1. Provide test reports for glazed aluminum curtain walls.
2. Test reports must be based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency.
3. Test reports must indicate compliance with performance requirements.

F. Fabrication Sample:

1. Provide a fabrication sample of each vertical-to-horizontal intersection of aluminum-framed curtain wall systems, made from 12" 12 inch (304.8 mm) lengths of full-size components and showing details of the following:
   a. Joinery
   b. Glazing

1.07 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer must have successfully installed the same or similar systemsrequired for the project and other projects of similar size and scope.

B. Manufacturer Qualifications:

1. Manufacturer must be capable of fabricating glazed aluminum curtain walls that meet or exceed the stated performance requirements.

C. Source Limitations:

1. Obtain aluminum curtain wall system through one source from a single manufacturer.

D. Product Options:

1. Information on drawings and in specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
2. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups:

1. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
2. Build mockups for the type(s) of curtain wall elevation(s) indicated, in location(s) shown on drawings.

F. Pre-installation Conference:

1. Conduct conference at project site to comply with requirements in Division 01 Project Management and Coordination Section.

1.08 PROJECT CONDITIONS

A. Field Measurements:

1. Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication.
2. Indicate measurements on shop drawings.

1.09 WARRANTY

A. Submit manufacturer's standard warranty for owner's acceptance.

B. Warranty Period:

1. Two years from Date of Substantial Completion of the project provided however that in no event shall the Limited Warranty begin later than six months from date of shipment by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product:

1. Kawneer Company, Inc.
2. 1600 Wall System®1 Curtain Wall types:
   a. 1600 Wall System®1 Curtain Wall:
      1) Sight line: 2-1/2" 2.5 inch (63.5 mm)
      2) Outside-glazed pressure plate format
      3) System depth: 6" 6 inch (152.4 mm) for 1" (1 inch (25.4 mm)) insulating glazing and 1/4" (0.25 inch (6.3 mm)) monolithic glazing
3. Tested to AAMA 501, ASTM E1886, E 1996, and TAS 201, 202, 203Subject to compliance with requirements, provide a comparable product by the following:

B. Substitutions:

1. Refer to Division 01 Substitutions Section for procedures and submission requirements.
2. Pre-Contract (Bidding Period) Substitutions:
   a. Submit written requests ten (10) days prior to bid date.
3. Post-Contract (Construction Period) Substitutions:
   a. Submit written request in order to avoid installation and construction delays.
4. Product Literature and Drawings:
   a. Submit product literature and drawings modified to suit specific project requirements and job conditions.
5. Certificates:
   a. Submit certificate(s) certifying that the substitute manufacturer (1) attests to adherence to specification requirements for curtain wall system performance criteria, and (2) has been engaged in the design, manufacture, and fabrication of aluminum curtain walls for a period of not less than ten (10) years. (Company Name).
6. Test Reports:
   a. Submit test reports verifying compliance with each test requirement required by the project.
7. Samples:
   a. Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

C. Substitution Acceptance:

1. Acceptance will be in written form, either as an addendum or modification.

2. Acceptance will be documented by a formal change order signed by the owner and contractor.

2.02 MATERIALS

A. Aluminum Extrusions:

1. Alloy and temper recommended by glazed aluminum curtain wall manufacturer for strength, corrosion resistance, and application of required finish
2. Not less than 0.070" 0.07 inch (1.8 mm) wall thickness at any location for the main frame
3. Complying with ASTM B221: 6063-T6 alloy and temper
4. Recycled Content:
    a. Shall have a minimum of 50% mixed pre- and post-consumer recycled content.
    b. Indicate recycled content, including the percentage of pre- and post-consumer recycled content per unit of product.
    c. Indicate the relative dollar value of recycled content product to the total dollar value of product included in the project.
    d. Indicate the location for recovery of recycled content.
    e. Indicate the location of the manufacturing facility.

B. Aluminum Sheet Alloy:

1. Shall meet the requirements of ASTM B209.

C. Fasteners:

1. Aluminum, nonmagnetic stainless steel or other materials must be non-corrosive and compatible with aluminum members, trim hardware, anchors, and other components.

D. Anchors, Clips, and Accessories:

1. Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating.
2. Anchors, clips, and accessories shall provide sufficient strength to withstand the design pressure indicated.

E. Pressure Plate:

1. Pressure plate shall be aluminum.
2. Pressure plate shall be fastened to the mullion with stainless steel screws.

F. Reinforcing Members:

1. Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating.
2. Reinforcing members must provide sufficient strength to withstand the design pressure indicated.

G. Sealant:

1. For sealants required within fabricated curtain wall system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

H. Thermal Barrier:

1. Thermal separator shall be extruded of a silicone compatible elastomer that provides a minimum 1/4" 0.25 inch (6.3 mm) separation.

I. Tolerances:

1. References to tolerances for wall thickness and other cross-sectional dimensions of glazed curtain wall members are nominal and in compliance with AA Aluminum Standards and Data.

2.03 CURTAIN WALL FRAMING

A. Framing Members:
   1. Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads
   2. Glazing System: Four-sided captured
   3. Glazing Plane: Front

B. Glass:
   1. Insulating glass options:
      a. 1" 1 inch (25.4 mm)

C. Brackets and Reinforcements:
   1. Manufacturer's standard high-strength aluminum with non-staining, non-ferrous shims for aligning system components.

D. Framing Sealants:
   1. Shall be suitable for glazed aluminum curtain wall as recommended by sealant manufacturer.Fasteners and Accessories:
   2. Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories must be compatible with adjacent materials.
   3. Where exposed, fasteners and accessories shall be stainless steel.

E. Perimeter Anchors:
   1. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

F. Packing, Shipping, Handling, and Unloading:
   1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

G. Storage and Protection:
   1. Store materials so that they are protected from exposure to harmful weather conditions.
   2. Handle material and components to avoid damage.
   3. Protect material against damage from elements, construction activities, and other hazards before, during, and after installation.

2.04 GLAZING

A. Glazing to meet requirements in Division 08 Glazing Section.

B. Available Glazing Options:
   1. 1600 Wall System®1 Curtain Wall:
      a. System depth: 6" 6 inch (152.4 mm) for 1" (1 inch (25.4 mm)) insulating glazing and 1/4" (0.25 inch (6.3 mm)) monolithic glazing

C. Glazing Gaskets:
   1. Gaskets to meet requirements of ASTM C864.

D. Spacers and Setting Blocks:
   1. Manufacturer's standard elastomeric type

E. Bond-Breaker Tape:
   1. Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
F. Glazing Sealants:
   1. As recommended by manufacturer for joint type.

2.05 OPERABLE UNITS

A. Doors comply with Division 08 Aluminum-Framed Entrances and Storefronts Section.
B. Windows comply with Division 08 Aluminum Windows Section.

2.06 FABRICATION

A. Extrude or form aluminum shapes before finishing.
B. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations
   2. Accurately fitted joints
   3. Physical and thermal isolation of glazing from framing members
   4. Accommodations for thermal and mechanical movements of glazing and framing that maintain required glazing edge clearances
   5. Provisions for field replacement of glazing from exterior
   6. Fasteners, anchors, and connection devices that are concealed from view to the greatest extent possible
   7. Internal weeping system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior
C. Curtain Wall Framing:
   1. Fabricate components for assembly using shear block system following manufacturer's standard installation instructions.
D. After fabrication, clearly mark components to identify their locations in project according to shop drawings.

2.07 ALUMINUM FINISHES

A. Finish designations that are prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
B. Factory Finishing:
   1. Kawneer Permafluor™ (70% PVDF), AAMA 2605, Fluoropolymer Coating (Color to be selected by owner from manufacturers full range of options)

PART 3 EXECUTION

3.01 EXAMINATION

A. With installer present, examine areas for compliance with requirements for installation tolerances and other conditions affecting performance of the work.
B. Proceed with installation only after correcting unsatisfactory conditions.

3.02 INSTALLATION

A. Curtain Wall System Installation:

1. Install curtain wall systems plumb, level, and true to line, without warp or rack of frames, within manufacturer's prescribed tolerances, and complying with installation instructions.
2. Provide support and anchor in place.
3. Dissimilar Materials:
    a. Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.
4. Glazing:
    a. Glass shall be outside-glazed.
    b. Glass shall be held in place with extruded aluminum pressure plates anchored to the mullion using stainless steel fasteners that are spaced no more than 9" 9 inch (228.6 mm) on center.
5. Water Drainage
    a. Each light of glass shall be compartmentalized using joint plugs and silicone sealant to divert water to the horizontal weep locations.
    b. Weep holes shall be located in the horizontal pressure plates and covers to divert water to the exterior of the building.

B. Related Products Installation:

1. Sealants (Perimeter):
    a. Refer to Joint Treatment (Sealants) Section.
2. Glass:
    a. Refer to Glass and Glazing Section.
    b. Reference: ANSI Z97.1, CPSC 16 CFR 1201, and GANA Glazing Manual.

3.03 FIELD QUALITY CONTROL

A. Field Tests:

1. Architect shall select curtain wall units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter-caulked, and cured.
2. Conduct tests for air infiltration and water penetration with manufacturer's representative present.
3. Tests that do not meet the specified performance requirements and units that have deficiencies shall be corrected as part of the contract amount.
4. Testing shall be performed per AAMA 503 by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements.
5. Air Infiltration Tests:
    a. Conduct tests in accordance with ASTM E783.
    b. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft2, whichever is greater.
6. Water Infiltration Tests:
    a. Conduct tests in accordance with ASTM E1105.
    b. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 8 psf (383 Pa).

B. Manufacturer's Field Services:

1. Upon owner's written request, provide periodic site visit by manufacturer's field service representative.

3.04 ADJUSTING, CLEANING, AND PROTECTION

A. Adjusting: Not applicable.

B. Protection:

1. Protect installed product's finish surfaces from damage during construction.
2. Protect aluminum curtain wall system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

C. Cleaning:

1. Repair or replace damaged installed products.
2. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance.
3. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during the construction period.
4. Remove construction debris from project site and legally dispose of debris.

END OF SECTION 084413

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical door hardware for the following:
   a. Swinging doors.
2. Cylinders for door hardware specified in other Sections.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
   b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
   c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
   d. Content: Include the following information:
      1) Identification number, location, hand, fire rating, size, and material of each door and frame.
      2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
      3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
      4) Fastenings and other pertinent information.
      5) Explanation of abbreviations, symbols, and codes contained in schedule.
      6) Mounting locations for door hardware.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

C. Warranty: Special warranty specified in this Section.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
   1. Warehousing Facilities: In Project's vicinity.
   2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
   3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:
   1. For door hardware, an Architectural Hardware Consultant (AHC) who is also an Electrified Hardware Consultant (EHC).

C. Source Limitations: Obtain each type of door hardware from a single manufacturer.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, 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.

E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
   1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

F. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

G. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines ICC/ANSI 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. 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.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.07 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including excessive deflection, cracking, or breakage.
   b. Faulty operation of doors and door hardware.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
   a. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 DOOR HARDWARE

A. Provide door hardware for each door as scheduled on Drawings to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color required for each new door leaf. Provide function as required by location.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.02 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
   a. Hager Companies.
   b. IVES Hardware; an Ingersoll-Rand company.
   c. McKinney Products Company; an ASSA ABLOY Group company.
   d. Stanley Commercial Hardware; Div. of The Stanley Works.

2.03 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
3. Deadbolts: Minimum 1.25-inch bolt throw.

C. Lock Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

D. Lock Trim:

1. Levers: Cast.
2. Escutcheons (Roses): Cast.
3. Dummy Trim: Match lever lock trim and escutcheons.
4. Operating Device: Lever with escutcheons (roses).

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

2.04 AUXILIARY LOCKS

A. Bored Auxiliary Locks: BHMA A156.5: Grade 1; with strike that suits frame.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
   a. Arrow USA; an ASSA ABLOY Group company.

b. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.05 SURFACE BOLTS

A. Surface Bolts: BHMA A156.16.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on the drawings or comparable product by one of the following:
   a. IVES Hardware; an Ingersoll-Rand company.

2.06 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
   a. Best Access Systems; Div. of Stanley Security Solutions, Inc.
   b. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.07 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.

1. Existing System:
   a. Master key or grand master key locks to Owner's existing system.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
   a. Notation: "DO NOT DUPLICATE."

2.08 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.

2.09 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
   a. DORMA Architectural Hardware; Member of The DORMA Group North America.
   b. LCN Closers; an Ingersoll-Rand company.
   c. Norton Door Controls; an ASSA ABLOY Group company

2.10 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. IVES Hardware; an Ingersoll-Rand company.

2.11 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
   a. National Guard Products.
   b. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
   c. Zero International.

2.12 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
   a. National Guard Products.
   b. Pemko Manufacturing Co.; an ASSA ABLOY Group company
   c. Zero International.

2.13 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:
   a. Wood or Machine Screws: For the following:
      1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.

2) Strike plates to frames.
3) Closers to doors and frames.

b. Steel Through Bolts: For the following unless door blocking is provided:
1) Surface hinges to doors.
2) Closers to doors and frames.
3) Surface-mounted exit devices.

3. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.14 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

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.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

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

3.02 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.03 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant..

E. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

F. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Glazed curtain walls.
   2. Storefront framing.
   3. Door and Window glazing.

1.03 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036.

C. Interspace: Space between lites of an insulating-glass unit.

D. Sealed Insulating Glass Unit Surface Designations:
   1. Surface #1 - Exterior surface of the outer glass lite
   2. Surface #2 - Interspace surface of the outer glass lite
   3. Surface #3 - Interspace surface of the inner glass lite
   4. Surface #4 - Interior surface of the inner glass lite or the interlayer surface of the first layer of laminated glass.
   5. Surface #5 - Interlayer surface of the second layer of laminated glass.
   6. Surface #6 - Interior surface of the second layer of laminated glass.

1.04 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. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E1300 by a New York State licensed professional engineer, using the following design criteria:
   1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
      a. Wind Design Data: As indicated on Drawings.
      b. Basic Wind Speed: 135 mph.
      c. Risk Category: III.
   2. Design Snow Loads: As indicated on Drawings.
   3. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.

4. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.05 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type; 12 inches (300 mm) square.

1. Fire-resistive glazing products.
2. Insulating glass.

C. Glazing Accessory Samples: For gaskets sealants and colored spacers, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers manufacturers of insulating-glass units with sputter-coated, low-e coatings glass testing agency and sealant testing agency.

B. Product Certificates: For glass and glazing products, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for tinted glass coated glass insulating glass glazing sealants and glazing gaskets.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Warranties: Sample of special warranties.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

E. Source Limitations for Glass: Obtain tinted float glass coated float glass laminated glass and insulating glass from single source from single manufacturer for each glass type.

F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

I. 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 for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F (232 deg C), and the fire-resistance rating in minutes. Fire resistance rated assemblies must be tested in accordance with ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials.

J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

K. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.08 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.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.09 PROJECT 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. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace 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: Ten (10) years from date of Substantial Completion.
B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that 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: Ten (10) years from date of Substantial Completion.
C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
   1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
   2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements"

Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes enhanced-protection testing requirements in ASTM E1996 for Wind Zone 1 when tested according to ASTM E1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.
   1. Large-Missile Test: For all glazing, regardless of height above grade.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   4. 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 (W/sq. m x K).
   5. 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.
   6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.02 GLASS PRODUCTS

A. Heat-Treated Float Glass: ASTM C1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
   2. For uncoated glass, comply with requirements for Condition A.
   3. For coated vision glass, comply with requirements for Condition C (other coated glass).

B. Pyrolytic-Coated, Self-Cleaning, Low-Maintenance Glass: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.
   1. Products <http://www.specagent.com/LookUp/?ulid=166&mf=04&src=wd>: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cardinal Glass Industries; LoE2 Plus
      b. Pilkington North America; Activ
      c. PPG Industries, Inc.; SunClean

C. Uncoated Tinted Float Glass: Class 2, complying with other requirements specified.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Solargray by PPG Industries or comparable product by one of the following:
      a. EFCO.
      b. Guardian Industries.
   2. Tint Color: Optigray.

3. Visible Light Transmittance: 76 for Clear glazing and 54 for Gray Tinted glazing percent minimum.

2.03 LAMINATED GLASS

A. Laminated Glass: ASTM C1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. 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 recommendations.
   2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
   3. Interlayer Color: Clear unless otherwise indicated.

B. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, with "Windborne-Debris-Impact Resistance" Paragraph in "Glass Products, General" Article, and with other requirements specified. 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 the following to comply with interlayer manufacturer's written recommendations:
      a. Polyvinyl butyral interlayer.
   2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
   3. Interlayer Color: Clear unless otherwise indicated.

C. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Laminated-Glass Types" Article.

2.04 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190, and complying with other requirements specified.
   1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
   2. Spacer: Manufacturer's standard warm edge spacer material and construction .
   3. Desiccant: Molecular sieve or silica gel, or blend of both.

B. Glass: Comply with applicable requirements in "Glass Products" Article and in "Laminated Glass" Article as indicated by designations in "Insulating-Glass Types" Article and in "Insulating-Laminated-Glass Types" Article.

2.05 FIRE-PROTECTIVE GLAZING

A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies.

B. Monolithic Ceramic Glazing: Clear, ceramic flat glass composed of glazing and fire-rated surface applied film, impact safety-rated glazing material, 3/16-inch (5-mm) nominal thickness.
   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. TGP; Firelite NT
      b. McGrory Glass; Schott Pyran Platinum F
      c. Vetrotech Saint-Gobain; Keralite Select FR-F (Safety Film)

C. Laminated Fire-Rated (20 to 180 minutes), High Impact Safety-Rated Ceramic Glass, Ultra-HD technology, 5/16 inch thickness meeting CPSC 16 CFR 1201 (Cat. I and II) and ANSI Z97.1 , withstands thermal shock. 5-year limited warranty. Surface Grade - Standard.
   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. TGP Firelite Plus
      b. McGrory Glass; Pyran Platinum L
      c. Verotech Saint-Gobain; Keralite Select FR-L
      d. Armoured One
      e. Architect approved equivalent.

2.06 FIRE-RESISTANCE RATED GLAZING

A. Multi-laminate Fire-Rated (45 to 120 minutes), Impact Safety-Rated Fireglass multi-laminate glass with clear intumescent interlayers, interior and exterior use, meets CPSC 16 CFR 1201 (Cat. I and II) and ANSI Z97.1 and providing protection against radiant and conductive heat transfer as per ASTM E119 and UL 263, withstands thermal shock. 5-year limited warranty. .
   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. Pilkington Pyrostop: 45-200: 45 min., 3/4 inch thick, STC 40, U-Value - .86.
      b. AGC Pyrobel by McGrory Glass: 45-120: 45 min., 3/4 inch thick.
      c. Architect approved equivalent.

B. Fire-rated glazed assemblies requiring compliance to ASTM E119: Glazing shall be Pilkington PyroStop; AGC Pyrobel by McGrory Glass or approved equal. Glazing shall be Clear, laminated fully insulating fire and impact-resistant glass or as selected by the Architect.

2.07 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
   1. Neoprene complying with ASTM C864.
   2. EPDM complying with ASTM C864.
   3. Silicone complying with ASTM C1115.
   4. Thermoplastic polyolefin rubber complying with ASTM C1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene EPDM gaskets complying with ASTM C509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.08 GLAZING SEALANTS

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. Sealants 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."
   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 C920, Type S, Grade NS, Class 100/50, 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. Dow Corning Corporation; 790
      b. GE Advanced Materials - Silicones; SilPruf LM SCS2700
      c. Pecora Corporation; 890
      d. Sika Corporation, Construction Products Division; SikaSil-C990
      e. Tremco Incorporated; Spectrem 1
C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.09 GLAZING TAPES

A. 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 C1281 and AAMA 800 for products indicated below:
   1. AAMA 804.3 tape, where indicated.
   2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
B. 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:
   1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
   2. 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, 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. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. 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.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

2.12 INSULATING GLASS TYPES

A. Interior Glass Type IIG-1: insulating glass.

1. Overall Unit Thickness: 1 inch.
2. Exterior Glass Lite: 1/4 inch tempered Optigray glass.
3. Interspace Content: Air (10%) / Argon (45%) / Krypton (45%).
4. Interspace Gap Size: 1/2 inch
5. Interior Glass Lite: 1/4 inch tempered Optigray glass.

B. Exterior Glass Type EIG-1: Low-E coated, insulating glass. (frosted glass at locker room area)

1. Overall Unit Thickness: 1 inch.
2. Exterior Glass Lite: 1/4 inch tempered Solarban 90 Low-E (2) Optigray glass.
3. Interspace Content: Air (10%) / Argon (45%) / Krypton (45%).
4. Interspace Gap Size: 1/2 inch

5. Indoor Glass Lite: 1/4 inch tempered Optigray glass with white frosted application on Number 3 surface to 20-30% opacity; submit at least (2) samples of varying percentages for selction by Owner and Architect.
6. Visible Light Transmittance: 44 percent minimum.
7. Winter Nighttime U-Factor: 0.24 maximum.
8. Solar Heat Gain Coefficient:0.23 maximum.

2.13 EXTERIOR LAMINATED INSULATING GLASS TYPES

A. Glass Type ELIG-1: Low-e-coated, insulating glass.
1. Overall Unit Thickness: 1.31 (with 0.060 PVB interlayer - 1/4" glass).
2. Exterior Glass Lite: 1/4 inch tempered Solarban 67 Low-E (2) StarPhire glass.
3. Interspace Content: Air (10%) / Argon (45%) / Krypton (45%).
4. Interspace Gap Size: 1/2 inch
5. Indoor Glass Lite: 1/4 inch heat strengthened Clear - 0.060 inch Clear PVB - 1/4 inch heat strengthened Clear.
6. Visible Light Transmittance: 35 percent minimum.
7. Winter Nighttime U-Factor: 0.24 maximum.
8. Solar Heat Gain Coefficient: 0.25 maximum.
9. Provide safety glazing labeling.

PART 3 - EXECUTION

3.01 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.

3.02 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 will leave visible marks in the completed work.

3.03 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.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. 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.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

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 (3-mm) 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.

H. 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.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. 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.

L. 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.

3.04 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 and then to jambs. Cover horizontal framing joints by applying tapes to jambs and 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.

3.05 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.

3.06 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.

3.07 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove non-permanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. 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; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
   2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.
   3. Partial Wall Framing Supports.
   4. Adjustable Aluminum Mullion/Partition Closures.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 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 E90 and classified according to ASTM E413 by an independent testing agency.

2.02 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C645 requirements for metal unless otherwise indicated.
   2. See "Corrosion Protection of Steel Framing" Article in the Evaluations for a discussion of corrosion-resistant coatings on components.
   3. Protective Coating: ASTM A653/A653M, G60 (Z180), hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C645. Use either steel studs and runners or dimpled steel studs and runners.
   1. Steel Studs and Runners:
      a. Minimum Base-Metal Thickness: 18 gauge (0.043 inch) and 20 gauge (0.033 inch) as indicated on the drawings.
      b. Depth: 4 inches, 3-5/8 inches, 2-1/2 inches, 1-5/8 inches as indicated on the drawings.
   2. Dimpled Steel Studs and Runners:
      a. Minimum Base-Metal Thickness: 20 gauge (0.027 inch).

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Deflection Track: Steel sheet top runner 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. Products: Subject to compliance with requirements, provide one of the following:
        1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
        2) Steel Network Inc. (The); VertiTrack VTD Series.
        3) Marino/Ware; Slotted Track SLT

D. Firestop Tracks: Top runner 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.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
    1. Minimum Base-Metal Thickness: As indicated on Drawings or a minimum of 0.033 inch.

F. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch wide flanges.
    1. Depth: 1-1/2 inches.
    2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C645.
    1. Minimum Base-Metal Thickness: 20 gauge (0.033 inch).
    2. Depth: 7/8 inch, 1-1/2 inches as indicated on the drawings.

H. Resilient Furring Channels: 1/2-inch deep, steel sheet members designed to reduce sound transmission.
    1. Configuration: Asymmetrical.
    2. Manufacturer: Clark- Dietrich; Model RCSD or Architect approved equal.

I. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 16 gauge (0.057 inch) gauge, and depth required to fit insulation thickness indicated.

J. Column Flange Grip Clips: Pre-manufactured Column/Beam connectors for rapid installation of board type materials to Steel Column and Beam Flanges. ASTM A1003/A1003M Structural Grade 33 (230) Type H, ST33H (ST230H): 33ksi (230MPa) minimum yield strength, 45ksi (310MPa) minimum tensile strength, 27mil minimum thickness (22 gauge, 0.0283” design thickness) with ASTM A653/A653M G60 (Z180) hot dipped galvanized coating. Manufacturer: The steel Network, Inc. Unit connection box measures 1 inch deep, 2 inches wide and 2 1/2 inches long with a spring clip depth of 2.375 inches and a curved clip spring clearance of .2 inches.
    1. Install as indicated on the drawings. Maximum spacing 24" on center.

2.03 SUSPENSION SYSTEMS

A. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

B. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch wide flanges.
   1. Depth: As indicated on Drawings.

D. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 16 gauge (0.054 inch) uncoated-steel thickness, with minimum 1 1/2-inch wide flanges, 3/4 inch deep.
   2. Dimpled Steel Studs and Runners: ASTM C645.
      a. Minimum Base-Metal Thickness: As indicated on Drawings or 20 gauge (0.033 inch).
      b. Depth: As indicated on Drawings.
   3. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.

2.04 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Metal Framing: Type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:
   1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), non-perforated.
   2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

C. Partial Wall Framing Supports: Pony Wall Heavy (PW) framing supports for partial height cantilever wall systems unsupported at the top track utilizing 12 gauge (0.107 inch thick) stud members, Structural Grade 50 (50 ksi minimum yield strength), ASTM A653 and ASTM A1003. Moment of Inertia: 0.7739 inches^4 for deflection design. Integral Heavy Base Plate; 12 inch thick, ASTM A36 (36 ksi minimum yield strength, 8 inches long x 3 3/8 inches wide x 1/2 inch thick plate with five bolt hole locations spaced per manufacturer to accept 1/2 inch diameter Hilti Kwik Bolt-3 in quantities indicated on the drawings. Manufacturer: Clark-Dietrich or Architect approved equivalent.
   1. Model(s): PW24 (23 3/4 inches long), PW36 (35 3/4 inches long), and PW48 (47 3/4 inches long) as indicated.

D. Adjustable Aluminum Mullion/Partition Closures: MULLION MATE – SERIES 40 PLUS extruded aluminum partition closure shall be manufactured by Gordon Interior Specialties Division, Gordon, Inc., 5023 Hazel Jones Road, Bossier City, LA 71111, (800) 747-8954, Fax (800) 877-8746, sales@gordoninteriors.com or approved equal.
   1. Aluminum extrusions: 6063-T5 temper, tensile strength 31 KSI, ASTM B221.
      a. Size(s): Mullion Mate 3: 2 7/8 inch through 3 15/16 inch, Mullion Mate 4: 4 inch through 4 15/16 inch, Mullion Mate 5: 5 inch through 6 15/16 inch, Mullion Mate 7: 7 inch through 9 3/4 inch, and Mullion Mate 9: 9 inch through 13 3/4 inch or as required by the field conditions.
      b. Length: 10 foot or as required by field conditions.
      c. Finish: Acrylic-Polyester hybrid powder-coat paint finish in color as selected by the Architect from the manufacturer's full color offering.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

3.02 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (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 required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.03 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment, services, heavy trim, grab bars, toilet accessories, and furnishings or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.04 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.

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.

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 (runners) 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 penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
3. 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.
4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
5. Curved Partitions:
    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
    c. Products such as Curv-Trak and Flex-C Trac may be submitted for approval to accomplish radius wall applications.

E. Direct Furring:

1. Screw to wood framing where applicable.
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-Furring Members:

1. Erect insulation, specified in Section 072100 - ASPHALT SHINGLES, vertically and hold in place with Z-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.

3.05 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types as indicated.
   1. Hangers: 48 inches o.c.
   2. Carrying Channels (Main Runners): 48 inches o.c.
   3. Furring Channels (Furring Members): 16 inches o.c.

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 supporting structural or 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.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
   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. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   5. Do not attach hangers to steel roof deck.
   6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
   7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
   8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. 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.

G. 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.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Fire resistive Type X Gypsum Board.
3. Trim and Accessories.
4. Joint treatment, tapes, compounds and finishing.
5. Miscellaneous metal framing, furring, and fasteners.
6. All related items necessary to complete the work of this section.

1.03 SUBMITTALS

A. Product Data: For each type of product.

1.04 DELIVERY, STORAGE AND HANDLING

A. 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.

1.05 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 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, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

PART 2 - PRODUCTS

2.01 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 E119 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 E90 and classified according to ASTM E413 by an independent testing agency.

2.02 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.03 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. National Gypsum Company.
   2. USG Corporation.
   3. Architect approved equivalent.

B. Gypsum Wallboard: ASTM C1396/C1396M.
   1. Thickness: 5/8 inch (15.9 mm) and 1/2 inch (12.7 mm).
   2. Long Edges: Tapered and featured (rounded or beveled) for Pre-filling.

C. Gypsum Board, Type X: ASTM C1396/C1396M.
   1. Thickness: 5/8 inch (15.9 mm) and 1 inch (25.4 mm).

2.04 SPECIALTY GYPSUM BOARD

2.05 TILE BACKING PANELS

2.06 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. L-Bead: L-shaped; exposed long flange receives joint compound.
      c. Expansion (control) joint.

B. PVC Rip Bead L-Trim (VLZL) with tear-away strip to be removed after drywall finishing and painting to form a crisp, clean edge. 0.028 PVC material with 5/8 inch Tear away flange, 10 foot lengths with perforated flanges. Manufacturer: ClarkDietrich or approved equal.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Fry Reglet Corp.
      b. Gordon, Inc.
      c. Pittcon Industries.
   2. Trim: 1/16 inch thick extruded aluminum 6063-T5 mill finish manufactured by Gordon Inc., (unless noted otherwise), Fry Reglet or Architect approved equivalent:
      a. J-Trim: Model JD-58 (5/8 inch gypsum board).
      b. Drywall Reveal Trim: Model DRM-625-625 (5/8 inch deep by 5/8 inch wide) with DRM-SNAP-IN-50 (fits 625 profiles)
      c. Wallcovering Outside Corner: WCTOSC
      d. Wallcovering Base / Termination: WCTBT125-217
      e. 3-Step Outside Corner: Model 902-3X-625 (5/8 inch gypsum - 5/8 inch gypsum).
      f. Drywall Control Joints: Model DRM-50-25 2-PC unless indicated otherwise on the drawings.

3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified or finish as specified on the drawings.

2.07 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. Tile Backing Panels: As recommended by panel manufacturer.

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. Pre-filling: At open joints, rounded or beveled panel edges, 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 compound.
   a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

2.08 MATERIALS

A. Metal Framing: Protective coating of framing shall conform to ASTM A653/A653M - G40 minimum, or shall be a protective coating with equal or better corrosion resistance.

1. Runners: In compliance with ASTM C645, provide 1-1/2” galvanized steel runners to match applicable assembly specified, to match wall framing members, unless indicated otherwise.
2. Furring members: In compliance with ASTM C645, provide galvanized cold rolled steel, 0.0296" minimum thickness of base metal or 20 gage min., screw type hat shaped channels; 7/8" depth, width approx. 2¾”, hemmed edges. Where furring channels are used in conjunction with resilient clips, width of channel shall be coordinated with clip configuration to ensure proper fit.
3. Vertical Supports: 1” x 1/8” steel flat bars installed a maximum 4’-0” on center, slotted for 3/8” diameter bolts at each end. 3” x 3” x 3/16” steel angle, slotted to receive 3/8” diameter bolt and faster to truss above with a safe working load of 300 pounds minimum.
4. Fasteners for Metal Framing: Provide fasteners of type, size, style, grade, holding power, class, and other properties required for secure installation of framing and furring. Galvanize all fasteners and accessories. All devices, other than bolts, used to interconnect ceiling members are required to be certified and listed by an Approved Agency.

B. Fasteners: Fasteners for securing board to metal furring or wood shall be Phillips Head, black oxidized screws made for fastening gypsum wall board, size and length as recommended by the drywall manufacturer for the applications shown.

2.09 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

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.

3.02 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C840.

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 (1.5 mm) 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. (0.7 sq. m) 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 (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4 to 1/2-inch (6.4 to 12.7-mm) 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. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

J. 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 C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.03 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Type X: As indicated on Drawings.
   2. Ceiling 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 horizontally (perpendicular 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. 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 (400 mm) 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. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.04 CONSTRUCTION TOLERANCES

A. Do not exceed 1/8" in 8'-0" variation from plumb or level in any exposed line or surface, except at joints between units do not exceed 1/16" variation between planes of abutting edges or ends.

Shim as required to comply with specified tolerances. Variations shall not be visible in finished surfaces.

B. For soffits and ceilings verify that direct suspension system has been installed properly, that main runners are spaced evenly and have been leveled to a tolerance of 1/8" in 12 feet measured both lengthwise on each runner and transversely between parallel runners so that furring member installation may proceed accurately.

3.05 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 Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Exposed Edges: Where an exposed edge of gypsum drywall abuts dissimilar materials use Gold Bond #C250 casing bead or equal. Casing beads to be finished with joint compound. Same casing bead and joint treatment is to be used on exposed wallboard edges.

D. Neatly cut all openings so that they may be covered by plates and escutcheons.

E. Place control joints consistent with lines of building spaces as directed.

1. Gypsum Panel surfaces should be isolated with control joints or other means where:
   a. Partition, furring or column fireproofing abuts a structural element (except floor) or dissimilar wall or ceiling;
   b. Ceiling abuts a structural element, dissimilar wall or partition or other vertical penetration; construction changes or ceiling;
   c. Construction changes within the plane of the partition or ceiling;
   d. Partition or furring run exceeds 30 feet;
   e. Ceiling dimensions exceed 50 feet in either direction;
   f. The area within separate ceiling sections exceeds 2,500 sq. ft.;
   g. Wings of "L", "U", and "T" shaped ceiling areas are joined;
2. Penetrations of the gypsum panel diaphragm, such as door frames, borrowed-light openings, vents, grilles, access panels and light troffers, require additional reinforcement at the corners to distribute concentrated stresses if a control joint is not used.
3. Place edge trim where gypsum board abuts dissimilar materials. Use longest practical length.
4. Provide additional framing and blocking as required to support gypsum board at openings and cutouts, and to support built-in anchorage and attachment devices for other work.
5. Coordinate installation of joint sealers specified in Section 079200 at penetrations and where abutting different materials.
6. Cornerbead: Use at outside corners unless otherwise indicated.
7. LC-Bead: Use where indicated.
8. L-Bead: Use where indicated.

3.06 FINISHING GYPSUM BOARD

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. Pre-fill open joints, rounded or beveled edges, 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. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated. All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Prepared surface shall be coated with a drywall primer/sealer prior to the application of finish paint.
    a. Primer and its application to surfaces are specified in Section 099113 - Exterior Painting and 099123 - Interior Painting.
3. Level 5: Where indicated on Drawings.
    a. Primer and its application to surfaces are specified in Section 099113 - Exterior Painting and 099123 - Interior Painting.

E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.07 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

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Ceramic and Porcelain tile.
2. Porcelain Paver Tile.
3. Waterproof membrane.
4. Tile backing panels.
5. Metal edge strips.

1.03 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 A118.1, ANSI A108.2, 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, and ANSI A108.17, which are contained in "American National Standard 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.

1.04 PERFORMANCE REQUIREMENTS

A. Dynamic Coefficient of Friction (DCOF AcuTest): For tile installed on walkway surfaces, provide products with the following values as determined by testing in accordance with ANSI standard ANSI A137.1, Section 9.6:

1. Wet & Level Interior Surfaces: minimum 0.42.
2. Step Treads: minimum 0.42.
3. Ramps and Inclined Surfaces: minimum 0.65.
4. Exterior Floors & Pool Decks: minimum 0.60.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product indicated including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. LEED Submittals:

1. LEED Data Submissions: See Section 018113 - SUSTAINABILITY DESIGN REQUIREMENTS for required submittals.

2. Product Data for EQ Credit: Low Emitting Materials - Emissions and Content Requirements. Provide documentation indicating products aare inherently nonemitting sources of VOCs and do not include integral organic-based surface coatings, binders, or sealants.
3. Product Data for Credit EQ 4.1: For tiling, documentation including printed statement of VOC content.
4. Laboratory Test Reports for Credit EQ 4: For tiling, documentation indicating that products 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."
5. Product Data for Credit EQ C61.2: For Flooring Systems, documentation including printed statement of VOC content.

C. Samples for Initial Selection: For each type of tile and grout indicated, provide full range of colors and patterns available from the approved manufacturer. Include Samples of accessories involving color selection.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer certifying that products meet or exceed the specified requirements of ANSI A137.1.

C. Product Certificates: For each type of product, signed by product manufacturer.

D. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.07 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.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum two years' experience.

B. Single Source Responsibility: Obtain each type and color of tile from a single source. Obtain each type and color of mortar, adhesive and grout from the same source.

1.09 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.

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

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.01 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 A108.2, 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. FloorScore Compliance: Tile for floors shall comply with requirements of FloorScore Standard.

D. 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.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation 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.

F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

G. Grout Release: High-performance, sacrificial, water-based coating to protect tile from grout residue and haze. Rinses with water during clean-up. Apply two coats and allow to cure for one -hour minimum prior to grouting. Installation and removal shall be as recommended by the manufacturer.

1. Manufacturer: Mapei "UltraCare" Grout Release or approved equal.

2.02 TILE PRODUCTS

A. Tile Type <>: Porcelain glazed floor tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. American Olean; Division of Dal-Tile International Inc.: Concrete Chic
   b. Daltile; Division of Dal-Tile International Inc.: ___
   c. Architect approved equivalent
2. Face Sizes: 12x24
3. Thickness: 5/16 inch.
4. Wearing Surface: Nonabrasive, smooth.
5. Finish: Matte, clear glaze.
6. Tile Colors: As selected by Architect from manufacturer's full color range.
7. Tile Patterns: As indicated on the drawings.
8. Grout Colors: As selected by Architect from manufacturer's full color range.
9. For Furan-grouted quarry tile, pre coat with temporary protective coating.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
    a. Base Trim: 6 x 12 Cove Base or as indicated on the drawings

B. Tile Type <>: Glazed Ceramic Wall Tile:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. American Olean.: Color Story Wall
2. Module Size: 8 inches x24 inches or as indicated on the drawings.
3. Thickness: 3/8 inch.
4. Face: Smooth
5. Finish: Matte or as indicated on the drawings.
6. Joint Width: 1/16 inch
7. Tile Colors: As selected by Architect from manufacturer's full color range..
8. Tile Patterns: As indicated on the drawings.
9. Grout Colors: As selected by Architect from manufacturer's full color range.

C. Glazed Wall Tile Accent Band:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Daltile: Keystones Colorbody Porcelan.
   b. Or approved equal.
2. Module Size: 1x1 Mosaic: Maple Blend DK26 or as indicated on the drawings.
3. Thickness: 5/16 inch.
4. Face: Square edges.
5. Finish: as selected by the Architect.
6. Tile Colors: 40 % Arctic White D617 40% Architecture Gray D109, and 20% Brownberry D118 Note, colors are subject to change pending on final approval by Owner. Contractor shall assume color availability from manufacturer's full color range.
7. Tile Patterns: Maple Blend DK26
8. Moisture Absorption: less than 20% (wall)
9. Scratch Hardness (MOHS): 4.0 - 6.0.
10. Grout Joint Width: 1/16 inch.

11. Grout Colors: As selected by Architect from manufacturer's full color range.
12. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes selected from manufacturer's standard shapes.

2.03 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108/A118/A136.1 or ASTM C1325, in maximum lengths available to minimize end-to-end butt joints. Provide 2 inch wide coated glass fiber tape for joints and corners.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Custom Building Products; Wonderboard.
      b. USG Corporation; DUROCK Cement Board.
   2. Thickness: 5/8 inch or as indicated.

2.04 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Chlorinated Polyethylene Sheet: Non-plasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.
   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. Noble Company (The); Nobleseal TS.
      b. Architect approved equivalent.

C. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Laticrete International, Inc.; Laticrete 9235 Waterproof Membrane.
      b. MAPEI Corporation; Mapelastic AquaDefense with MAPEI Fiberglass Mesh.
      c. Architect approved equivalent.

D. MAPEI – Mapeguard WP200
   1. Description: Flexible polyethylene sheet membrane with polypropylene fabric on both sides with a low perm rating ideal for vapor protection in showers, wet areas, and steam rooms. Thickness is 0.02” (40 -50 mils nominally), blue in color.
   2. Waterproofing seaming membrane:
      a. Provide MAPEI Mapeguard WPST Seam Tape and Mapeguard PIC & POC Corners material 0.004" (4 mil) thick, polyethylene membrane, with polypropylene fleece laminated on both sides.
   3. Waterproofing Accessories:
      a. Provide MAPEI Mapeguard VC, (Valve seals).
      b. Provide MAPEI Mapeguard PC, (Pipe seals).

E. Schluter®-KERDI or approved equal.
   1. Description: 0.008" (8 mil) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides, which meets or exceeds the requirements of the “American National Standard specifications for load bearing, bonded, waterproof membranes for thin-

set ceramic tile and dimension stone installation A118.10," and is listed by cUPC®, and is evaluated by ICC-ES (see Report No. ESR-2467 and PMG 1204).

2. Waterproofing seaming membrane:
   a. Provide Schluter®-KERDI-BAND Seams and Corners material 0.004" (4 mil) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides.
3. Waterproofing Accessories:
   a. Provide Schluter®-KERDI-SEAL Mixing Valve seals.
   b. Provide Schluter®-KERDI-SEAL pipe seals.

2.05 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Laticrete International, Inc.
   b. MAPEI Corporation; Keraflex Super
   c. TEC; a subsidiary of H. B. Fuller Company.
2. Provide prepackaged, dry-mortar mix containing dry, redispersable, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.
4. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.06 GROUT MATERIALS

A. Polymer-Modified Tile Grout: ANSI A118.7.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Laticrete International, Inc.
   b. MAPEI Corporation; Ultracolor Plus FA
   c. TEC; a subsidiary of H. B. Fuller Company.
2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersable form, prepackaged with other dry ingredients.
3. Polymer Type: Acrylic resin in liquid-latex form for addition to prepackaged dry-grout mix.

B. Water-Cleanable Epoxy Grout: {\rs\#1}, ANSI A118.3 100 percent solids, non-sag/non-slump, chemical resistant with color-coated quartz and a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D. Provide at all Toilet Room Floors, Locker Rooms, and locations indicated on the Drawings.

1. Basis-of-Design Product: MAPEI Corporation; Kerapoxy CQ or comparable product by one of the following:
   a. Laticrete International, Inc.
   b. TEC; a subsidiary of H. B. Fuller Company.
2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.

C. Grout for Pre-grouted Tile Sheets: Same product used in factory to pre-grout tile sheets.

2.07 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Section {\id\#1000071} - {\t\#1000071}.
   1. Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. Multi-part, Pourable Urethane Sealant for Use T: ASTM C920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
   1. See Section {\id\#1000071} - {\t\#1000071} for additional information.

2.08 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; stainless-steel, ASTM A666/A666M, 300 Series exposed-edge material.

C. Decorative Color Coated Tile Edge and Finishing Profiles: Schluter®-RONDEC, symmetrically rounded visible surface with 1/4" radius bullnose profiles with integrated trapezoid-perforated anchoring leg and integrated grout joint spacer; extruded aluminum with color-coated finish color and height as selected by the architect. Provide inside and outside corner connectors and special shapes for a complete installation.

D. Temporary Protective Coating: Product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
   1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
   2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
      a. MAPEI Corporation; “UltraCare” Grout Release

E. 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.
   1. Products:
      a. MAPEI Corporation; “UltraCare” Everyday Stone, Tile & Grout Cleaner

F. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

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. Bonsal American; an Oldcastle company; Grout Sealer.
   b. Bostik, Inc.; CeramaSeal Grout & Tile Sealer.
   c. C-Cure; Penetrating Sealer 978.
   d. Custom Building Products; Grout and Tile Sealer.
   e. Jamo Inc.; Penetrating Sealer.
   f. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout.
   g. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
   h. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
   i. TEC; a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone Grout Sealer.

2.09 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

3.01 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 installed tile.

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 thin-set 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.

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

3.02 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Protect surrounding work from damage.

C. Remove any curing compounds or other contaminants.

D. Vacuum clean surfaces and damp clean.

E. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1a and is sloped 1/4 inch per foot (1:50) toward drains.

F. 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.

G. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, pre coat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.03 TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic 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. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
    c. Tile floors composed of rib-backed tiles.

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. 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.
4. For Plank type tiles, install staggered in a "running bond" brick joint pattern with no more than 33 % overlap to prevent lippage and warping.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/8 inch (1.6 mm).
2. Porcelain Floor Tile: 3/16 inch (4.8 mm) minimum.
3. Paver Tile: 1/8 inch.
4. Glazed Porcelain Wall Tile: 1/8 inch (4.8 mm).
5. Decorative Thin Wall Tile: 1/8 inch (1.6 mm).
6. Quarry Tile: 1/4 inch (6.3 mm)

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Section {\id\#1000071} - {\t\#1000071}.

I. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

J. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.04 TILE BACKING PANEL INSTALLATION

A. Install cementitious backer units and treat joints according to ANSI A118.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.05 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.06 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove epoxy and latex-portland cement 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. For epoxy grout installations utilize recommended grout haze cleaner as recommended by the tile manufacturer. 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. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. 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.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed. After seven days, cover areas subject to construction traffic with heavy cardboard.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.07 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:
   1. Tile Installation F115A: Thin-set mortar; epoxy grout; TCNA F115A.
      a. Tile Type: Glazed Porcelain floor tile.
      b. Thin-Set Mortar: Latex- portland cement mortar.
      c. Grout: Water-cleanable epoxy grout.

B. Interior Wall Installations, Metal Studs or Furring:
   1. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCNA W244F.
      a. Tile Type: Glazed Porcelain wall tile.
      b. Thin-Set Mortar: Latex- portland cement mortar.
      c. Grout: Polymer-modified sanded grout.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes acoustical panels and exposed suspension systems with accessories and trims for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices.

C. Exposed Grid Suspension Systems - 15/16 inch

1.03 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 (150 mm) in size.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component including decorative moldings, equal to 2 percent of quantity installed.
3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages 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.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.08 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, 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.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.09 WARRANTY

A. Provide manufacturer's 30-year limited systems warranty covering defects in materials and / or factory workmanship for ceiling panels and suspension systems.

B. Provide manufacturer's 10-year limited warranty covering sagging and warping defects caused by materials or factory workmanship for Humidity and Moisture-resistant ceiling systems.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE 7.

B. Surface-Burning Characteristics: Comply with ASTM E84 testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

2.02 ACOUSTICAL PANELS, GENERAL

A. Low-Emitting Materials: Acoustical panel ceilings 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. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

C. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

D. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E795.

E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.03 ACOUSTICAL PANELS ACP-1 (ARMSTRONG - CORTEGA)

A. Basis-of-Design Product Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Armstrong World Industries, Inc.: Cortega. (Square Lay-in & Regular)
2. Architect approved equivalent.

B. Classification: Provide panels complying with ASTM E1264 for type, form, and pattern as follows:

1. Type and Form: Type III, mineral base with factory-applied latex paint; Form 2, water felted; with Durabrite acoustically transparent membrane. .

C. Color: White.

D. Texture: Fine

E. Light Reflectance (LR): ASTM E1477; Not less than .83.

F. Noise Reduction Coefficient (NRC): ASTM C423; Not less than 55.

G. CAC: ASTM C1414; Not less than 35.

H. Articulation Class (AC): ASTM E1111/E1111M; Classified with UL label.

I. Edge/Joint Detail: Square Tegular

J. Thickness: 5/8 inch

K. Modular Size: Item No. 704 - 24 by 24 inches (610 by 610 mm)

L. Grid size: 15/16 inch

M. Weight: 1.05 psf.

N. Insulation Value: R Factor: 2.2 (BTU Units) / 0.39 (Watt Units).

O. Fire Performance: Class A (UL)

P. Mold/Mildew Inhibitor: Front and Back of each panel shall be treated with BIOBLOCK, paint containing a biocide to inhibit / retard the growth of mold or mildew, ASTM D3273.

Q. Humidity/Sag Resistance: Humiguard Plus protection.

R. VOC Emissions: GREENGUARD Gold Certified, ANSI/GBI Green Building Assessment Protocol, LEED WELL Building Standard, and UL 2818 Low Chemical Emissions UL.COM/GG.

2.04 ACOUSTICAL PANELS ACP-2 (ARMSTRONG - CORTEGA)

A. Basis-of-Design Product Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Armstrong World Industries, Inc.: [Cortega]. (Square Lay-in & Regular)
2. Architect approved equivalent.

B. Classification: Provide panels complying with ASTM E1264 for type, form, and pattern as follows:
   1. Type and Form: Type IV, mineral base with factory-applied latex paint; Form 2, water felted; with Durabrite acoustically transparent membrane. .
   2. Pattern: E or as indicated by manufacturer's designation.

C. Color: White.

D. Texture: Smooth

E. Light Reflectance (LR): ASTM E1477; Not less than 0.85.

F. Noise Reduction Coefficient (NRC): ASTM C423; Not less than 0.85.

G. Ceiling Attenuation Class (CAC): ASTM C1414; Not less than 35.

H. Articulation Class (AC): ASTM E1111/E1111M; Classified with UL label: 170

I. Edge/Joint Detail: Angled Tegular.

J. Thickness: 5/8 inch.

K. Modular Size: Item No. 769 - 24 by 48 inches

L. Grid size: 15/16 inch

M. Weight: 1.0 lb/sq. ft.

N. Insulation Value: R Factor: 2.9 (BTU Units) / 0.445 (Watt Units).

O. Fire Performance: Class A (UL)

P. Mold/Mildew Inhibitor: Front and Back of each panel shall be treated with BioBlock, paint containing a biocide to inhibit / retard the growth of mold or mildew, ASTM D3273.

Q. Humidity/Sag Resistance: Humiguard Plus protection.

R. VOC Emissions: GREENGUARD Gold Certified, ANSI/GBI Green Building Assessment Protocol, LEED WELL Building Standard, and UL 2818 Low Chemical Emissions UL.COM/GG.

S. Recycled Content: up to 76% total recycled content.

2.05 METAL SUSPENSION SYSTEMS, GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C635/C635M.
   1. High-Humidity Finish: Comply with ASTM C635/C635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.

2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- (3.5-mm-) diameter wire.

E. Cold Rolled Channel: 1 1/2 inch deep, 16 MSG cold rolled steel with protective zinc coating. Tie to supporting structure with 12 SWG galvanized wire ties. Install at 4'-0" o.c. maximum or as indicated on the drawings.

F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place. Conform to "Code of Practices for Acoustical Ceiling System Installations" by CISCA - Ceilings & Interior Systems Contractors Association.

I. Hold-Down Clips: Provide manufacturer's standard hold-down clips (Armstrong CHDC, Rockfon 490.00, or approved equivalent) spaced 24 inches (610 mm) o.c. on all cross tees. At exterior locations provide Exterior Hold Down Clips in size determined by the panel thickness (Armstrong EHDC, Rockfon 490.00, or equal).

J. Retention Clips: Provide Armstrong 414 Retention Clips in Gymnasium and Activity spaces. Install as recommended by the manufacturer to secure each panel.

2.06 METAL SUSPENSION SYSTEM - 15/16 GRID

A. Basis-of-Design Product Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Armstrong World Industries, Inc.: Prelude plus XL.
2. CertainTeed Corp.
3. Chicago Metallic Corporation.

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 according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation; with prefinished 15/16-inch (24 mm) wide metal caps on flanges.

1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: butt-edge type.
3. Face Design: Flat, flush.
4. Grid and Cap Material: Hot-dip galvanized steel with Aluminum cap.
5. Cap Finish:
   a. White for acoustical panel installations.
   b. Color as selected by the Architect for the 360 Painted Grid system.

2.07 METAL EDGE MOLDINGS AND TRIM

A. Basis-of-Design Product : Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Armstrong World Industries, Inc. 15/16 inch edge Angles, Moldings and Trims compatible with the grid specified.
2. Chicago Metallic Corporation.
3. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile 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. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. 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.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

C. Extruded Aluminum, Sheet-Metal Edge Moldings and Trim: Axiom Trim type and profile indicated.

PART 3 - EXECUTION

3.01 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.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C636/C636M and seismic design requirements indicated, according to 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 either to structures 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. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
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 (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) 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. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

D. 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 (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:
   a. As indicated on reflected ceiling plans.
   b. Install panels with pattern running in one direction parallel to short axis of space.
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 clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.

1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
   a. Within each test area, testing agency will select one of every 10 power-actuated fasteners and post-installed anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two post-installed anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
   b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

C. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.05 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. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Resilient base.

1.03 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 Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.

1.04 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. Furnish not less than 10 linear feet (3 linear m) for every 300 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.05 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) nor more than 90 deg F (32 deg C).

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) nor more than 95 degrees F, in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

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

2.01 THERMOPLASTIC-RUBBER BASE

A. Manufacturers:
   1. Roppe Corporation, USA
   2. Allstate Rubber Corp.
   3. Burke Mercer Flooring Products, Division of Burke Industries Inc.
   4. Johnsonite; A Tarkett Company
   5. Architect approved equivalent.

B. Product Standard: ASTM F1861, Type TS (Thermoset Vulcanized Rubber).
   1. Group: 1 (solid, homogeneous).
   2. Style and Location:
      a. Style B, Cove: Provide in areas with resilient flooring.

C. 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.

D. Thickness: 0.125 inch.

E. Height: 6 inches or as indicated on Drawings.

F. Lengths: 120-foot Coils or in manufacturer's standard coil length.

G. Outside Corners: Preformed.

H. Inside Corners: Preformed.

I. Colors: As selected by Architect from manufacturer's full range of colors.

2.02 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.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   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.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are the same temperature as the 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.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.03 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.

3.04 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 exposed 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. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.

1. Apply two coat(s).

E. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Vinyl composition Floor Tile. (VCT)
   2. Homogeneous Vinyl Floor Tile (HVT)

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2021.

C. ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading; 2022.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2022.

E. ISO 9001 - Quality Management Systems — Requirements; 2015.

F. Install resilient floor tiles in accordance with the recommended method of the "Tile Contractors Association of America" Handbook.

1.04 SUBMITTALS

A. Product Data: For each type of product.

B. Installation Instructions: Provide a copy of the manufacturer's installation instructions to the Owner's Construction Representative.

C. Samples: Two (2) Full-size units of each color and pattern of floor tile / plank required.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of this Section with minimum 5 years documented experience.

B. Perform moisture tests to ascertain moisture content of concrete floors scheduled to receive resilient tile flooring and base.
   1. Concrete subfloors to receive Solid Vinyl shall meet the following requirements for moisture and alkalinity levels:

a. Moisture vapor emissions shall not exceed three (3) pounds per 1,000 square feet for 24 hours.
b. Alkalinity levels shall be between 7.0 and 9.0 pH.

2. Contractor shall submit to the Architect a written report on the moisture and surface alkalinity of the concrete subfloors verifying compliance with the acceptable parameters listed herein or to the more stringent requirements required by the manufacturer PRIOR to the installation of new flooring materials.

C. Resilient floor tiles and plank shall be of through-pattern construction and shall contain recycled vinyl content as a percentage of the product composition. Tiles shall be asbestos free.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project 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.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered and stored under the provisions of 016500 - {\t\#1000031}.

B. 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 or more than 90 deg F. Store floor tiles / planks on flat surfaces.

C. Deliver materials to project site in original, unopened packages, labeled to allow easy identification.

D. Handle materials carefully to avoid chipping edges or damaging tiles in any way.

1.09 MAINTENANCE MATERIALS

A. Furnish an extra 3% of each tile type, lot, shape, size, gloss, and color in clean, clearly marked containers to the Owner for maintenance use.

1.10 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 degrees F or more than 95 deg F in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Close spaces to traffic for 48 hours after floor tile installation.

C. Install floor tile after ambient conditions have been met; testing and other finishing operations, including overhead work, dust generating activities and painting, have been completed.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM D648 or NFPA 253 by a qualified testing agency.

2.02 SOLID COLOR VINYL COMPOSITION FLOOR TILE

A. Products:
   1. TOLI International: Fasol Plus (HVT - Basis of Design)
   2. Architect approved equivalent.

B. Critical Radiant Flux (CRF): Minimum 0.45 watts per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.

C. Minimum Requirements: Comply with ASTM F1066 of Class corresponding to type specified.

D. Tile Standard: ASTM F1066.
   1. Class: 1
   2. Type: Class A - Smooth Surface.

E. Thickness: 0.125 inch.

F. Size: 17.7 inch x 17.7 inch

G. Edge: Square

H. Colors and Patterns: As selected by Architect from full range of industry colors. Contractor shall assume (1) Field Tile as the base bid.
   1. **Add-Alternate G-4**: Contractor shall assume (2) accent colors as per drawing A420. Final layout to be furnished by Architect at time of submittals.

I. Warranty: Manufacturer Warranty. Provide manufacturer's ten (10) year limited warranty to be free from defects in material and workmanship, under normal commerical use and service to repair or replace all effected tiles including reasonable labor.

2.03 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.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

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.

3.02 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: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
    a. Perform anhydrous calcium chloride test according to ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lbs. of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

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 they are the same temperature as the 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.

3.03 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile. Provide a copy of the Manufacturer's Installation Instructions to the Owner's Construction Representative prior to the commencement of work of this Section.

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 unless indicated otherwise on the contract documents.
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.
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 non-permanent marking device.
G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
H. Adhere floor tiles to flooring 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.
I. Set flooring in place, press with heavy roller to attain full adhesion.
J. Where applicable for certain floor tile and plank patterns, apply specially formulated acrylic grout between the tiles / planks in strict accordance with the manufacturer's recommendations.
K. Lay tile in full bond with grain in all tile running in one direction. Coordinate with Architect before installation for direction of grain.
L. Install feature strips, edge strips and floor graphics / markings as indicated. Fit joints tightly.
M. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
N. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.
O. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
P. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
   1. Apply two coat(s).

Q. Cover floor tile until Substantial Completion.

END OF SECTION

PART 1.0 – GENERAL

1.01 REFERENCE STANDARDS

A. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine; 2017.
B. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).
C. ASTM D3389 - Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader); 2021.
D. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
E. ASTM E492 - Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine; 2009, with Editorial Revision (2016).
F. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).
G. ASTM E2179 - Standard Test Method for Laboratory Measurement of the Effectiveness of Floor Coverings in Reducing Impact Sound Transmission Through Concrete Floors; 2021.
H. ASTM F925 - Standard Test Method for Resistance to Chemicals of Resilient Flooring; 2013 (Reapproved 2020).
I. ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading; 2022.

1.02 SUMMARY

A. The work of this section includes:
    1. Ecore Athletic FlexTurf Motivate
    2. Ecore Athletic FlexTurf Monster
B. Related Sections: Section(s) related to this section include:
    1. Concrete Substrate: Division 3 Concrete Section(s)
    2. Plywood Substrate: Division 6

1.03 REFERENCES

A. Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title, or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
B. American Society for Testing and Materials (ASTM):
    1. See Part 2.0 PROPRIETARY MANUFACTURER/PRODUCTS below

C. Leadership in Energy and Environmental Design – LEED™

1. International Organization for Standardization™ document, ISO 14021 - Provides guidance on the terminology, symbols, testing and verification methodologies that an organization should use for self- declaration of the environmental aspects of its products and services.

1.04 SYSTEM DESCRIPTION

A. Performance Requirements: Provide turf wear surface with Vulcanized Composition Rubber base layer resilient flooring, which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.

1.05 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. LEED: Provide documentation of how the requirements for credit will be met.

1. List of proposed materials with recycled content. Indicated pre-consumer and post-consumer content.
2. Product data and certification letter indicating percentage of recycled content for both pre-consumer and post-consumer content.
3. Recycled content is defined in accordance with the International Organization for Standardization document, ISO 14021 Environmental labels and declarations.
    a. Post-consumer material – waste materials diverted from the waste stream after consumer or commercial use.
    b. Pre-consumer material – materials diverted from the waste stream during the manufacturing process. Excluded are regrind, rework, and scrap.

C. Product Data: Submit product data, including manufacturer’s guide specifications product sheet, for specified products.

D. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns, and textures.

E. Samples: Submit selection and verification samples for finishes, colors, and textures.

F. Quality Assurance Submittals: Submit the following:

1. Certificates: If required, certification of performance characteristics specified in this document shall be provided by the manufacturer.
2. Manufacturer’s Instructions: Manufacturer’s installation instructions.
    a. Specifier Note: Coordinate paragraph below with Part 3.05 Field Quality Requirements Article herein. Retain or delete as applicable.
3. Manufacturer’s Field Reports: Manufacturer’s field reports specified herein.

G. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operational Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
2. Warranty: Warranty documents specified herein.

1.06 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
      a. Certificate: When requested, submit certificate, indicating qualification.
   2. Manufacturer's Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.
      a. Specifier Note: Paragraph below should list obligations for compliance with specific code requirements particular to this section. Repetitive statements should be avoided.

B. Mock-Ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner and Architect's acceptance of finish color, texture and pattern and workmanship standard. Comply with Division 1 Quality Control (Mock-up Requirements) Section.
   1. Mock-Up Size: (Specify mock-up size.)
   2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
   3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

C. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's instructions, and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.

D. Pre-installation Testing: Conduct pre-installation testing as follows: (Specify substrate testing; consult with flooring manufacturer.)

1.07 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirements Sections.

B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Storage and Protection: Store materials at temperature and humidity conditions recommended by manufacturer and protect from exposure to harmful weather conditions.

1.08 PROJECT CONDITIONS

A. Temperature Requirements: Maintain air temperature in spaces where products will be installed for time period before, during, and after installation as recommended by manufacturer.

B. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.09 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not a limitation of other rights Owner may have under Contract Documents.

a. Specifier Note: Coordinate paragraph below with manufacturer's warranty requirements.

1) Warranty Period: (Specify term) years commencing on Date of Substantial Completion.

1.10 MAINTENANCE

A. Extra Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals (Maintenance Materials) Section.

1. Quantity: Furnish quantity of recycled rubber flooring units equal to (specify %) of amount installed.
2. Delivery, Storage, and Protection: Comply with Owner's requirements for delivery, storage, and protection of extra materials.
3. Cleaning: Furnish flooring manufacturer's neutral cleaner for initial cleaning and maintenance of the finished floor surface.

PART 2.0 – PRODUCTS

2.01 SPECIFIER NOTE: RETAIN ARTICLE BELOW FOR PROPRIETARY METHOD SPECIFICATION. ADD PROTECT ATTRIBUTES, PERFORMANCE CHARACTERISTICS, MATERIAL STANDARDS, AND DESCRIPTIONS AS APPLICABLE. USE OF SUCH PHRASES AS "OR EQUAL" OR "OR APPROVED EQUAL" OR SIMILAR PHRASES MAY CAUSE AMBIGUITY IN SPECIFICATIONS. SUCH PHRASES REQUIRE VERIFICATION (PROCEDURAL, LEGAL AND REGULATORY) AND ASSIGNMENT OF RESPONSIBILITY FOR DETERMINING "OR EQUAL" PRODUCTS.

2.02 MANUFACTURER:

A. Address: 715 Fountain Ave., Lancaster, PA 17601: Telephone: (866) 795-2732,

1. (717) 295-3400: Fax (717) 295-3414; Email: info@ecoreintl.com

2.03 PRODUCTS

A. Ecore FlexTurf Monster

B. Ecore Performance Modzilla Rolls with an 8mm Base Layer and a 0.1 inch (2.5 mm) EPDM surface layer, field united to a 15mm or 1.26 inch (32 mm) interlocking Shock Pad tile.

C. Ecore Mod15 and Mod 32 15mm or 1.26 inch (32 mm) thick Interlocking Shock Pad tile (for Modzilla)

D. Or Approved Equal

2.04 PERFORMANCE:

A. TURF

FlexTurf Monster consisting of an 8mm 6010SP, 10mm 6010SP, 12mm 4735, or 15mm 4735 Vulcanized Composition Rubber Shock Pad, field-united with a 15mm (5/8”) Polyethylene Turf Surface Layer. Total system thickness of approx. 23mm, 25mm, 27mm or 30mm respectively.			
Performance Criteria	Test Method	Result	
Turf Sheet Dimensions	Manufacturer	15’ wide by custom length	
6010SP & 4735 ShockPad Sheet Dimensions	Manufacturer	4’ wide by custom length	
Standard Tolerance Width	Manufacturer	+3/4” -0”	
Standard ShockPad Tolerance Length	Manufacturer	+1% -0”	
15mm (5/8”) Turf Weight	Manufacturer	0.52 lbs/sf	
8mm 6010SP Shockpad Weight	Manufacturer	1.10 lbs/sf	
10mm 6010SP Shockpad Weight	Manufacturer	1.32 lbs/sf	
12mm 4735 Shockpad Weight	Manufacturer	1.65 lbs/sf	
15mm 4735 Shockpad Weight	Manufacturer	2.22 lbs/sf	
Total Sheet Weight with 8mm 6010SP	Manufacturer	1.62 lbs/sf	
Total Sheet Weight with 10mm 6010SP	Manufacturer	1.84 lbs/sf	
Total Sheet Weight with 12mm 4735	Manufacturer	2.17 lbs/sf	
Total Sheet Weight with 15mm 4735	Manufacturer	2.74 lbs/sf	
Coefficient of Friction	ASTM D2047	??? 0.8	
Force Reduction	Deltec Field Tester	8mm = 49.2% 12mm = 54.1%	10mm = 53.0% 15mm = 55.0%
Energy Restitution	Deltec Field Tester	8mm = 35.2% 12mm = 29.7%	10mm = 32.2% 15mm = 35.3%
Vertical Deflection / Deformation	Deltec Field Tester	8mm = 7.7mm 12mm = 7.6mm	10mm = 8.1mm 15mm = 7.9mm
G-Max	Clegg	8mm = 70 12mm = 69	10mm = 70 15mm = 59

V.O.C. Compliant	CA 01350	Pass
Flammability – Pill Test	ASTM D2859	Pass

B. RUBBER FLOORING

Performance Modzilla System with itsTRU™ Technology 8mm Base Layer / 2.5mm Surface Layer

field-united to a floating 15mm or 32 mm Interlocking Shock Pad Tile

Total system thickness using 15mm x 24" x 48" Interlocking Shock Pad Tile: 25.5mm (1") Total system thickness using 32mm x 24" x 48" Interlocking Shock Pad Tile: 42.5mm (1-5/8")

Made from a formulation of high-quality post-consumer vulcanized composition rubber granules encapsulated in a wear and water-resistant elastomeric network with a fusion bonded reprocessed ColorMill™ EPDM

surface layer.

Performance Criteria	Test Method	Typical Results	
		Mod15	Mod32
Static Load Limit @250 psi	ASTM F970 @ 250 PSI	N/A	0.020”
Slip Resistance / Coefficient of Friction	ASTM D2047	>0.90	>0.90
VOC's / FloorScore / CHPS / CA 01350	ASTM D5116	Pass	Pass
Color Stability	ASTM F1515	Good	Good
Chemical Resistance	ASTM F925	Good	Good
Abrasion Resistance	ASTM D3389	<1g, 1,000 cycles	<1g,1,000 cycles
Resistance to Heat by Color Change	ASTM F1515	Pass	Pass
Resistance to Heat by Color Change	ASTM F1514	Pass	Pass
Flammability – Critical Radiant Flux	ASTM E648	Class II	Class II
Flammability – Pill Test	ASTM D2859	Pass	Pass
Force Reduction	Deltec	54.20%	41.78%
Energy Restitution	Deltec	50.90%	52.02%
Vertical Deformation	Deltec	4.4 mm	3.4mm
Impact Insulation Class (IIC)	ASTM E492	58	61
Sound Transmission Class (STC)	ASTM E90	56	56

Delta IIC	ASTM E2179	26	27
Modzilla System Thickness Tolerance (Beast Roll over Mod15 or Mod30)	Manufacturer	+/- 1.1mm / 0.043 in.	+/- 1.1mm / 0.043 in

15mm or 32 mm Interlocking Shock Pad Tile (for Modzilla) Made from a formulation of high-quality post-consumer vulcanized composition rubber granules encapsulated in a wear and water-resistant elastomeric network		
Performance Criteria	Test Method	Typical Results
Tile width	Manufacturer	24 in.
Tile length	Manufacturer	48 in.
Tile thickness	Manufacturer	15mm or 32 mm
VOC's / FloorScore / CHPS / CA 01350	ASTM D5116	Pass
Standard tolerance thickness	Manufacturer	+ .5 mm

a. PRODUCT SUBSTITUTIONS
   1) A. Substitutions: see specification section 012500 – PRODUCT SUBSTITUTION PROCEDURES
b. RELATED MATERIALS
   1) A. Related Materials: Refer to other sections listed in Related Sections paragraph herein for related materials.
c. SOURCE QUALITY
   1) A. Source Quality: Obtain recycled rubber resilient flooring materials from a single manufacturer.

PART 3.0 – EXECUTION

3.01 SPECIFIER NOTE: REVISE ARTICLE BELOW TO SUIT PROJECT REQUIREMENTS AND SPECIFIER'S PRACTICE.

A. MANUFACTURER'S INSTRUCTIONS
   1. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.
B. EXAMINATION
   1. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
C. PREPARATION
   1. Surface Preparation: Specify applicable product preparation requirements.

3.02 SPECIFIER NOTE: COORDINATE ARTICLE BELOW WITH MANUFACTURER'S RECOMMENDED INSTALLATION DETAILS AND REQUIREMENTS.

A. ERECTION / INSTALLATION / APPLICATION / CONSTRUCTION

1. Recycled Rubber Flooring Installation: Comply with Ecore Athletic Installation Manual for installation procedures and techniques.
2. Finish Color/Textures/Patterns: All finishes are to be selected by owner from full range of products finishes
    a. Wrestling and Gymnastics flooring to include owner approved logo and lettering
3. Related Products Installation: Refer to other sections listed in Related Sections paragraph herein for related products installation.

B. FIELD QUALITY REQUIREMENTS

    1) Specifier Note: Edit paragraph below. Establish number and duration of periodic site visits with Owner and manufacturer, and specify below. Consult with manufacturer for services required. Coordinate paragraph below with Division 1 Quality Assurance Section and Part 1 Quality Assurance Submittals herein. Delete
    2) if manufacturer's field service not required.

2. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
    a. Site Visits: Specify number and duration of periodic site visits.

C. CLEANING

1. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

D. PROTECTION

1. Protection: Protect installed product and finished surfaces from damage during construction.

E. SCHEDULES

1. Schedules: Specify reference to applicable schedules.

END OF SECTION

1.01 SUMMARY

A. Section includes:

1. Epoxy terrazzo with divider and accessory strips.
2. Precast terrazzo units.

1.02 DEFINITIONS

A. NTMA: National Terrazzo and Mosaic Association, Inc.

1.03 PREINSTALLATION MEETINGS

A. Pre installation Conference: The General Contractor shall conduct a conference at project site before Terrazzo Contractor begins installation.

1. The General Contractor shall invite Terrazzo Contractor, the Architect and representatives of the Owner.
2. Review methods and procedures related to terrazzo including, but not limited to, the following:
   a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
   b. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
   c. Review terrazzo mixes and patterns.
   d. Review custom terrazzo mixes, designs and patterns.
   e. Coordination with the work of other installers.

1.04 ACTION SUBMITTALS

A. Product Data: Terrazzo Contractor shall submit Product Data for each type of product required for installation including:

1. Strip materials.
2. Sealer.

B. Shop Drawings: Terrazzo Contractor shall prepare and submit Shop Drawings that include plans, elevations, sections, component details and attachments to other work. Include terrazzo installation requirements. Show layout of the following:

1. Divider strips.
2. Expansion joint strips.
3. Accessory strips.
4. Abrasive strips.
5. Stair treads, risers and landings.
6. Terrazzo patterns.

C. Samples:

1. Terrazzo Contractor shall prepare and submit a maximum of three samples, 6 inch (152.4 mm) by 6 inch size for each color and type of terrazzo specified.
2. Terrazzo Contractor shall submit three samples, 6 inch (152.4 mm) by 6 inch size for each color and type of precast terrazzo specified.

D. Samples for Initial Selection: Terrazzo Contractor shall submit NTMA “Color Palette Brochure” showing full range of colors and patterns available for each terrazzo type.

E. Samples for Verification: Terrazzo Contractor shall prepare and submit samples for each type, material, color and pattern of terrazzo and accessory required showing the full range of color, texture and pattern variations expected.
   1. Terrazzo: 6 inch (152.4 mm) by 6 inch samples
   2. Accessories: 6 inch (152.4 mm) long Samples of each type and kind of exposed strip item required
   3. Precast Terrazzo Units: Samples, sizes 6 inch (152.4 mm) by 6 inch for each color and type of precast terrazzo specified.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: Terrazzo Contractor shall submit two copies of qualification data.
   1. Include list of projects indicating name and location of project, name of Owner, name and contact information for General Contractor, and name and contact information for Architect.
   2. Include letter from NTMA with the name of the Project and name of member, stating current member status.

B. Material Certificates:
   1. Epoxy Resin: For each type of resin required indicating that materials meet specification requirements, by manufacturer.
   2. Aggregate: For each type of aggregate required indicating compatibility with terrazzo mix, signed by aggregate supplier.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Literature: Terrazzo Contractor shall submit two copies of maintenance recommendations from NTMA.

1.07 QUALITY ASSURANCE

A. Acceptable Epoxy Resin Manufacturer: An Associate Member of the NTMA, experienced in manufacturing epoxy resin in accordance with NTMA standards and with a record of successful in-service performance, as well as sufficient production capacity to produce required materials.

B. Acceptable Terrazzo Contractor: A Contractor Member of NTMA whose work has resulted in construction with a record of successful in-service performance.
   1. Installer shall have completed terrazzo installations within the past 5 years of scale and complexity similar to the proposed installation.

C. Source Limitations for Aggregates: Terrazzo Contractor shall obtain each color, grade, type and variety of granular materials from sources with resources to provide materials of consistent quality in appearance and physical properties.

D. Mockups: Terrazzo Contractor shall construct mockup if required in bid or scope of work documents to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup as directed by the Architect.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered to Project site in supplier's original wrappings and containers, labeled with source or manufacturer's name, material or product brand name, and lot number if any.

B. Materials shall be stored in their original, undamaged packages and containers, in a location where they will not be exposed to direct sunlight.

1. Epoxy components shall be stored in a space where the ambient temperature can be maintained 60 and 90 degrees Fahrenheit (32.22 degrees Celsius) before use.

1.09 PROJECT CONDITIONS

A. The General Contractor shall ensure provision of sufficient water, temporary heat and light, and adequate electric power with suitable outlets connected and distributed for use within 100 feet (3048 cm) of any working space.

B. The General Contractor shall provide temporary enclosures and other suitable methods to protect adjacent spaces from damage during installation.

1. Maintain ambient temperatures in the area to receive terrazzo at not less than 60 degrees Fahrenheit (15.56 degrees Celsius).
2. Maintain adequate ventilation in the area to receive terrazzo.

C. The Terrazzo Contractor shall protect other adjacent work from water and dust generated by grinding operations.

1. 1.10 GUARANTEE

D. A. One-year from date of substantial completion of terrazzo installation.

PART 2 PRODUCTS

2.01 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM C131/C131M - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine; 2020.

C. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.

D. ASTM D56 - Standard Test Method for Flash Point by Tag Closed Cup Tester; 2022.

E. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

F. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

G. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2022.

H. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics; 2015.

I. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems; 2020.

J. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine; 2017.

K. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

L. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2022.

M. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

2.02 PERFORMANCE

A. Recycled Content of Terrazzo Flooring Materials: Provide aggregates with a postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

B. Regional Materials: Provide marble chips, aggregate, and sand that has been extracted, harvested, or recovered, as well as manufactured within 500 miles (804.67 kilometers) of Project site.

C. Low-Emitting Materials: Flooring 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. Epoxy Resin:

1. Test Specimens: Mix resin materials according to manufacturer's recommendation without aggregate added and cure for 7 days at 75 degrees plus or minus 2 deg. F and 50 percent plus / minus 2 percent relative humidity.
2. Cured test specimens shall meet or exceed the following requirements:
    a. Hardness: 60 to 85 per ASTM D2240, Shore D.
    b. Minimum Tensile Strength: 3000 psi (20684.28 kPa) per ASTM D638 for a 2-inch specimen made using a “C” die per ASTM D412.
    c. Minimum Compressive Strength: 10,000 psi (68947.60 kPa) per ASTM D695, Specimen B cylinder.
    d. Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D1308.
        1) Distilled Water.
        2) Mineral Oil.
        3) Isopropanol.
        4) Ethanol.
        5) Soap solution at 1 percent.
        6) Sodium hydroxide at 10 percent solution.
        7) Hydrochloric acid at 10 percent solution.
        8) Hydrochloric acid at 30 percent solution.
        9) Detergent Solution at 0.025.
        10) Acetic Acid at 5 percent solution.

E. Epoxy Resin with Aggregate:

1. Test Specimens:

a. Mix epoxy resin according to manufacturer's recommendations and blend one volume of epoxy resin with 3 volumes of marble aggregate, consisting of:
   1) 60 percent No. 1 chip.
   2) 40 percent No. 0 chip.
b. Grind and grout with epoxy resin finished to a nominal 1/4 inch (6.35 mm) thickness.
c. Cure specimens 7 days at 75 degrees Fahrenheit (23.89 degrees Celsius) plus / minus 2 degrees and 50 percent (plus / minus 2 percent) relative humidity.

2. Cured epoxy terrazzo specimens shall nominally meet the following requirements:
   a. Flammability: Self- extinguishing, extent of burning 1/4 inch (6.35 mm) maximum according to ASTM D635.
   b. Coefficient of Linear Thermal Expansion: 0.000025 inch (0 mm)/inch per degree F per ASTM C531.

F. Bond Strength of Epoxy Terrazzo: 300 psi (2068.43 kPa) in concrete according to ASTM D7234 (modified to cut slightly into concrete).

2.03 MATERIALS

A. Epoxy Resin Matrix: Two-component, high solids product complying with specified performance requirements.
   1. Color: As required for mix indicated.

B. Primer: As recommended, manufactured and supplied by epoxy resin manufacturer.

C. Aggregates: marble chips, synthetic, and glass.
   1. Comply with NTMA gradation standards.
   2. Abrasion and Impact Resistance: Loss of 40 percent or less when tested according to ASTM C131/C131M (LA Abrasion).
   3. Aggregates shall contain no deleterious or foreign matter.

D. Divider Strips:
   1. Material: White alloy of zinc.
   2. Strip Thickness: 16 gauge.
   3. Type: “L” strip: 3/8 inch (9.52 mm) by 1/2 inch (12.7 mm).
   4. Heavy Top Thickness: 1/8 inch (3.18 mm).

E. Abrasive Strips: Abrasive nosing strip and two-line abrasive inserts at nosing. Silicon carbide or aluminum oxide, or combination of both, in epoxy resin binder and set in channel
   1. Width: 1/2 inch (12.7 mm)
   2. Depth: As required by terrazzo thickness
   3. Length: 4 inches (101.6 mm) less than stair width.
   4. Color: Darker than Terrazzo as selected by the Architect.

2.04 PRECAST TERRAZZO

A. Precast Terrazzo Base: Minimum 3/8-inch-thick, epoxy terrazzo units cast in maximum lengths possible, but not less than 36 inches (914.4 mm). Comply with precast manufacturer's written recommendations for fabricating precast terrazzo base units in sizes and profiles indicated.
   1. Type: As indicated.
   2. Top Edge: Radius Edge with polished top surface.
   3. Outside Corner Units: With finished returned edges or mitered at outside corner.
   4. Color, Pattern, and Finish: As selected by Architect from full range of industry colors.

B. Precast Terrazzo Stair Units: Minimum 3/4 inch (19.05 mm) thick terrazzo stair units. Comply with precast manufacturer's written recommendations for fabricating precast terrazzo units in sizes and profiles indicated. Reinforce units as required by unit sizes, profiles, and thicknesses and as recommended by manufacturer. Finish exposed-to-view edges and reveals to match face finish. Ease exposed edges to 1/8-inch radius.
   1. Provide the following types of precast stair units:
      a. Stair treads.
      b. Stair risers.
      c. Stair landings.
   2. Color, Pattern, and Finish: As selected by Architect from full range of industry colors.

C. Setting Materials for Precast Terrazzo: One of the following acceptable to the manufacturer of precast terrazzo units.
   1. Latex-Portland Cement Mortar (Thin Set): ASTM C270.
   2. Epoxy Adhesive: Two component, compatible with terrazzo units and substrate, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.05 MISCELLANEOUS ACCESSORIES

A. Sealer: Terrazzo Contractor shall provide a non-ambering, clear sealer that is chemically neutral; does not impair terrazzo aesthetics or physical properties; is recommended by terrazzo matrix manufacturer. Sealers shall comply with the following:
   1. Comply with requirements of authorities having jurisdiction.
   2. Comply with ASTM D2047.
   3. Water Based Sealer Properties: With pH factor between 7 and 10.
   4. Solvent Based Sealer Properties: Flashpoint at 80 deg. F or above according to ASTM D56.
   5. Sealers shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Moisture Mitigation: Two-component, high solids, moisture tolerant, high density, low odor, epoxy-based product produced by epoxy terrazzo resin manufacturer specifically recommended to reduce alkalinity levels and moisture emission to not more than 3 lbs/ per 1000 sq. ft per 24 hours.

C. Crack Suppression/Isolation Membrane: As recommended, produced and supplied by approved terrazzo resin formulator, having minimum 120 percent elongation potential per ASTM D412.

2.06 MIXES

A. Terrazzo Selection: Terrazzo Contractor shall provide standard terrazzo mix(es) according to the following:
   1. NTMA Plate No.
   2. Mix Color: As selected by Architect from NTMA color plates.
   3. Custom Mix Color and Pattern:
      a. Color No. 1:
         1) Epoxy Resin Color:
         2) Chips: No.1 percent

3) Chips: No. 2 percent

b. Color No. 2:

1) Epoxy Resin Color:

2) Chips: No.1 percent

3) Chips: No. 2 percent

c. Color for Base:

1) Epoxy Resin Color:

2) Chips: No.1 percent

3) Chips: No. 2 percent

4. Custom Mix Color and Pattern: Match Architect's Sample.

B. Proportions for Epoxy Terrazzo Topping: Comply with resin supplier’s recommendations.

C. Mixing of Terrazzo Topping: Mix epoxy components with aggregates in accordance with manufacturer's recommendations.

PART 3 EXECUTION

3.01 EXAMINATION

A. The General Contractor and Architect shall examine substrates and areas, with Terrazzo Contractor present, for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

1. Slab Flatness Tolerance: Subfloor is not to vary more than 1/4 inch (6.35 mm) from true plane in a 10 foot span.
2. Cracks: Locate cracks and joints in concrete substrates. Verify location of control joints and expansion joints in epoxy terrazzo flooring.
   a. If required to prevent cracks in concrete substrates transmitting through epoxy terrazzo flooring, the Terrazzo Contractor shall make a written recommendation to install a crack suppression membrane and include specific recommendations on type and location.

B. The General Contractor shall retain the services of an independent testing laboratory to verify that concrete substrates are dry by one of the methods below and moisture-vapor emissions are within acceptable levels according to epoxy resin manufacturer's written instructions.

1. Perform relative humidity test using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
2. Perform anhydrous calcium chloride test, ASTM F1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. of slab area in 24 hours.
3. If required to prevent moisture vapor transmission in concrete substrates, the Terrazzo Contractor shall make a written recommendation to install moisture mitigation materials and include specific recommendations on type and location.

C. The General Contractor shall be responsible for correcting non-conforming concrete substrates using materials compatible with epoxy terrazzo flooring system and as approved by the Terrazzo Contractor.

1. Materials used to correct nonconforming conditions must be compatible with the selected epoxy system and be approved by the manufacturer of epoxy resin materials and Terrazzo Contractor.

D. The Terrazzo Contractor shall proceed with installation only after unsatisfactory conditions, including flatness tolerances, cracking, and excessive moisture vapor transmission have been corrected.

3.02 PREPARATION

A. The General Contractor shall broom clean area to receive terrazzo to remove loose chips and all foreign matter.

B. Terrazzo Contractor shall mechanically abrade concrete surface.

C. Terrazzo Contractor shall provide moisture mitigation materials according to instructions and recommendations of moisture mitigation materials manufacturer. Cost for moisture mitigation materials and installation shall be included in the Base Bid.

D. Terrazzo Contractor shall provide flexible epoxy crack isolation/suppression membrane: Cost for materials and installation for installation over not more than ten percent of the floor area receiving epoxy terrazzo shall be included in the Base Bid. Cost for additional materials and installation for installation an additional cost to the Owner under an approved Change Order.

3.03 POURED-IN-PLACE TERRAZZO INSTALLATION

A. Strip Materials: Terrazzo Contractor shall install strip materials as follows:
   1. Divider and Control-Joint Strips:
      a. Locate divider strips in locations indicated.
      b. Install control joint strips back to back in locations indicated.
      c. Install strips in epoxy adhesive without voids below strips.
   2. Accessory Strips: Install as required to provide a complete installation.

B. Placing Terrazzo:
   1. Prime subfloor in accordance with manufacturer's recommendations.
   2. Proportion and thoroughly blend the materials.
   3. Place mixture to achieve specified thickness.
   4. Abrasive Strips: Install with surface of abrasive strip positioned 1/16 inch (1.59 mm) higher than terrazzo surface.

C. Poured in Place Terrazzo Base: Terrazzo Contractor shall provide mix color for terrazzo base to match approved sample.
   1. Terrazzo Contractor shall place and finish terrazzo base at the same time the terrazzo floor is being installed.

D. Poured in Place Terrazzo Stairs: Terrazzo Contractor shall provide mix color for treads and risers to match main terrazzo field, terrazzo border, and as indicated on the drawings.
   1. Place and finish terrazzo stair treads and risers at the same time the terrazzo floor is being installed.

E. Finishing: Terrazzo Contractor shall finish the terrazzo topping as follows:
   1. Rough Grinding:

a. Grind with 24 or finer grit stones or with comparable diamond abrasives.
b. Follow initial grind with 60/80 grit stones or with comparable diamond abrasives.

2. Grouting:
   a. Clean terrazzo with clean water and rinse. Allow to dry.
   b. Apply epoxy grout per manufacturer's instructions.
   c. Allow grout to cure.
3. Fine Grinding/Polishing: Grind with 120 grit or with comparable diamond abrasives until all grout is removed from surface.

F. Terrazzo Cleaning: Terrazzo Contractor shall clean finished terrazzo as follows:

1. Remove grinding residue from terrazzo surface.
2. Wash terrazzo surfaces immediately after final grinding of terrazzo flooring with water and allow surfaces to dry thoroughly.

G. Sealing: Terrazzo Contractor shall seal terrazzo according to sealer manufacturer’s written instructions.

3.04 PRECAST TERRAZZO INSTALLATION

A. Terrazzo Contractor shall install precast terrazzo units as follows:

1. Precast Terrazzo Base: Use latex-portland cement mortar or water-cleanable, tile-setting epoxy to install precast terrazzo base over substrates indicated according to ANSI 108.5 or ANSI 108.6.
2. Precast Terrazzo Stair Units: Use latex-portland cement mortar or epoxy adhesive to install treads, risers, and landings over concrete substrates according to ANSI 108.5 or ANSI 108.6.
3. Precast Terrazzo Stair Units: Use epoxy adhesive to install treads, risers, and landings over steel substrates according to ANSI 108.6.

3.05 REPAIR

A. Terrazzo Contractor shall repair terrazzo areas that evidence lack of bond between topping and underbed according to NTMA’s written recommendations.

3.06 PROTECTION

A. After application of the sealer, the Work shall be ready for final inspection and acceptance by the Owner.

B. The General Contractor shall protect the finished floor after the Terrazzo Contractor has completed final grinding and applied sealer to terrazzo surfaces.

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Epoxy floor coating system with integral cove base.

B. Surface preparation.

1.02 REFERENCES

A. ASTM ASTM D3363 - Hardness Testing.

B. ASTM D1044 - Resistance of Transparent Plastic Materials to Abrasion.

1.03 SUBMITTALS

A. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

B. Manufacturer's Installation Instruction: Indicate special procedures and perimeter conditions requiring special attention.

C. Manufacturer’s Material Safety Data Sheet (MSDS) for each product being used.

D. Upon request, provide 3 inch x 3 inch sample demonstrating floor color, texture and thickness and a six inch long cove base sample of the approved product selection.

1.04 QUALITY ASSURANCE

A. The Manufacturer shall have a minimum of 10 years experience in the production, sales, and technical support of epoxy and urethane industrial flooring and related materials.

B. The Applicator shall have experience in installation of the flooring system as confirmed by the manufacturer in all phases of surface preparation and application of the product specified.

C. A pre-installation conference shall be held between Applicator, General Contractor and the Owner's Representative to review and clarification of this specification, application procedure, quality control, inspection and acceptance criteria and production schedule.

D. Manufacturer of Approved System shall be single source and made in the USA.

1.05 DELIVERY, STORAGE AND HANDLING

A. All components of the system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the product type and batch number.

B. The Applicator shall be provided with a storage area for all components. The area shall be between 60 F and 90 F, dry, out of direct sunlight and in accordance with the Manufacturer's recommendations and relevant health and safety regulations.

C. Store materials for three days prior to installation in area of installation to achieve temperature stability.

D. Copies of Material Safety Data Sheets (MSDS) for all components shall be kept on site for review by the Owner's Representative or other personnel working with or around the material.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperature required by manufacturer three days prior to, during and 24 hours after installation of materials.

1.07 WARRANTY

A. Provide 5-year manufacturer's warranty.

B. Warranty: Include coverage against flooring delamination from substrate and degradation of surface finish.

1.08 MAINTENANCE DATA

A. Submit maintenance data.

B. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface and suggested schedule for cleaning.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Dur-A-Quartz, Epoxy-based seamless flooring system as manufactured by Dur-A-Flex, Inc., 95 Goodwin Street, East Hartford, CT 06108, Phone: (860) 528-9838, Fax: (860) 528-2802

B. Or approved equal.

2.02 MATERIALS

A. Primer: Dur-A-Flex, Inc, Dur-A-Glaze #4 WB resin and hardener.

1. Percent Solids 56 %
2. VOC 2 g/L
3. Bond Strength to Concrete ASTM D 4541 550 psi, substrates fails
4. Hardness, ASTM D 3363 3H
5. Elongation, ASTM D 2370 9 %
6. Flexibility (1/4: Cylindrical mandrel), ASTM D 1737 Pass
7. Impact Resistance, MIL D-2794 >160
8. Abrasion Resistance ASTM D 4060, CS17 wheel, 1,000 g 30 mg loss

B. Broadcast and Grout Floor Coating: 100% solids epoxy resin.

1. VOC 3.8 g/L
2. Compressive Strength, ASTM D 695 17,500 psi
3. Tensile Strength, ASTM D 638 2,100 psi
4. Flexural Strength, ASTM D 790 5,100 psi
5. Abrasion Resistance, ASTM D 4060
   C-10 Wheel, 1,000 gm load, 1,000 cycles 29 mg loss
6. Flame Spread/NFPA-101, ASTM E 84 Class A
7. Impact Resistance MIL D-24613 0.0007 inches, no cracking or delamination
8. Water Absorption. MIL D-24613 Nil
9. Pot life @ 70 F 20 minutes

C. Aggregate: The quartz aggregate shall be Dur-A-Flex, Inc. Q-28 or Q-11 colored quartz aggregate, ASTM D451, manufactured by 3M Company or approved equal; color as selected by Architect from manufacturer's full line.

D. Grout Coat: Dur-A-Flex, Inc. Dur-A-Glaze #4 resin and Water Clear hardener.

E. Top Coat - Dur-A-Flex Poly-Thane 2 or Armor Top (Sherwin Williams GP4638 Urethane Seal Coat for the Sherwin Williams system).

1.	Percent Solids	95 %	
2.	VOC	0 g/L	
3.	Tensile Strength, ASTM D 2370		7,000 psi
4.	Adhesion, ASTM 4541		Substrate Failure
5.	Hardness, ASTM D 3363	4H	
6.	600 Gloss ASTM D 523	70	
7.	Abrasion Resistance, ASTM D4060		Gloss Satin
	CS 17 wheel (1,000 g load) 1,000 cycles		4 8 mg loss/grit
			10 12 mg loss without grit
8.	Pot Life, 70 F, 50% RH		2 Hours
9.	Full Chemical Resistance		7 days

F. Patch Materials

1. Shallow Fill and Patching: Use Dur-A-Flex, Inc. Dur-A-Glaze # 4 Cove-Rez.
2. Deep Fill and Sloping Material (over ¼ inch): Use Dur-A-Flex, Inc. Dur-A-Crete

2.03 ACCESSORIES

A. Primers and Fillers: Waterproof; types recommended by flooring manufacturer.

B. Expansion Joints/Joint Fillers: Types recommended by flooring manufacturer for specific application.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.

B. Verify that surfaces are smooth and flat with maximum variation of 1/4 inch in 10 feet, and are ready to receive work.

C. Verify concrete floors have cured a minimum of 28 days, are dry to a maximum moisture content of 7 percent, and exhibit negative alkalinity, carbonization or dusting.

3.02 PREPARATION

A. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.

B. Moisture Testing: Perform tests recommended by manufacturer and as follows.

1. Perform relative humidity test using is situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
2. If the relative humidity exceeds 75% then Dur-A-Flex, Inc Dur-A-Glaze MVP Primer moisture mitigation system must be installed prior to resinous flooring installation. Slab-on grade substrates without a vapor barrier may also require the moisture mitigation system.

C. There shall be no visible moisture present on the surface at the time of application of the system. Compressed oil-free air and/or a light passing of a propane torch may be used to dry the substrate.

D. Mechanical surface preparation

1. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 4-5 as described by the International Concrete Repair Institute.
2. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
3. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.
4. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer’s recommendations.

E. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

F. Vacuum clean substrate.

G. Apply primer as per manufacturer's recommendations.

3.03 INSTALLATION FLOORING

A. Apply floor coating system in accordance with manufacturer's instructions. Form integral ¼ inch radius cove base 6 inches high with same materials as floor coating. Apply four finish coats minimum and spread aggregate uniformly in accordance with the manufacturer's instructions.

B. The system shall be applied in seven distinct steps as listed below:

1. Substrate preparation
2. Priming
3. First broadcast coat application with first aggregate broadcast
4. Second broadcast coat with second aggregate broadcast
5. Grout coat application, sand floor (if required)
6. First topcoat application
7. Second topcoat application

C. Install expansion joints and/or joint filler as per manufacturer's instructions.

D. The finish floor will have a nominal thickness of 1/8 inch.

3.04 PROTECTION OF FINISHED WORK

A. Protect finished work until work is complete. Cure flooring material in compliance with manufacturer’s directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.

B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

C. Barricade area to protect flooring until fully cured.

END OF SECTION

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PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Section specifies decorative pre-finished panel with pre-engineered hardware trim system. Mounting of panels is to be executed with adhesive and no exposed fasteners. The division or joinery trim is available in a variety of decorative and functional options.
   1. Wood Veneer on fiber board substrate panels.
   2. High-Pressure Laminate (HPL) on fiber board substrate panels.
   3. Hardware.

1.02 REFERENCE STANDARDS:

A. ANSI A208.2 Medium Density Fiberboard (MDF) for Interior Applications.

B. Architectural Woodwork Institute (AWI): Architectural Woodwork Standards, 2nd Edition.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Locate trim members to ensure panel lines coordinate with doors, headers, jambs, and other discontinuities in walls.
   2. Coordinate with vapor barrier installer to ensure vapor barrier is used on exterior walls behind backing for framed decorative panel system.

B. Coordinate delivery of framed decorative panel system materials to casework fabricator for incorporation into casework.
   1. Ensure materials are clearly marked related to project and casework location.

1.04 SUBMITTALS

A. Make submittals in accordance with Section 013300 - SUBMITTALS.

B. Product Data: Manufacturer’s standard specifications and descriptive literature, including:
   1. Product characteristics.
   2. Safety Data Sheets (SDS) for adhesives, sealants, and other pertinent materials prior to delivery to site.

C. Samples:
   1. Samples for Selection: Submit manufacturer’s standard color and pattern selection samples representing manufacturer’s full range of available colors and patterns.
   2. Samples for Verification: Submit sample for each component and for each exposed finish required, prepared on samples of size indicated below complete with exposed molding and trim samples.
      a. Ensure samples indicate type, finish and color specified.
         1) Wood Veneer: Submit sample sets of each Marlite Signature Select AA Grade wood veneer with finish choice.
            (a) Ensure 6 x 6-inch sample shows full range of normal color and texture variations anticipated.
            (b) Include sample of both Classic Clear Topcoat and Custom Stain.
         2) High-Pressure Laminate (HPL) sample chip by HPL manufacturer of choice.

D. Manufacturer’s written instructions, including:

1. Delivery, storage, and handling recommendations.
2. Preparation and installation recommendations.

E. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

F. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria, and physical requirements.

G. Warranty: Fully executed, issued in Owner's name and registered with manufacturer, including:

1. Manufacturer's 30-day warranty covering defects in materials.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Supply maintenance data for framed decorative panel system for incorporation into manual specified in Section 017800 - CLOSEOUT SUBMITTALS.

B. Record Documentation: In accordance with Section 017800 - CLOSEOUT SUBMITTALS.

1. List materials used in framed decorative panel system work.
2. Warranty: Submit warranty documents specified.

1.06 QUALITY ASSURANCE

A. Installer: Experienced in performing work similar to work of this Section.

1.07 DELIVERY, STORAGE & HANDLING

A. Deliver materials in accordance with manufacturer's written instructions.

1. Deliver materials on strong pallets in manufacturer's original, unopened, undamaged containers with identification labels intact and product name and manufacturer clearly visible and in sizes to suit project.
2. Inspect each package for damage and promptly contact Marlite, Inc. directly to report damaged packages or missing components

B. Store materials in manufacturer's unopened packaging until ready for installation.

1. Maintain temperature range of 60° to 80°F and humidity range of 35 to 55 % during storage, installation, and product life cycle.
2. Maintain plastic or other protective wrap in place during on site handling until ready for installation.
3. Keep panels clean and do not stack panels after removal of protection.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 FIELD CONDITIONS

A. Do not use wood or fiber board products in kitchens, rest rooms, or other high humidity areas.

B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits in accordance with manufacturer's written recommendations for optimum results.

1. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

A. Project Warranty: Refer to Contract Conditions for project warranty provisions.

B. Manufacturer's warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official.

1. Manufacturer's warranty is in addition to and not intended to limit other rights Owner may have under Contract Conditions.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Marlite®, Inc.: Contact Information: 1 Marlite Drive, Dover, Ohio 44622; Phone: (330) 343-6621, Phone: (800) 377-1221; FAX: (330) 343-7296; Email: info@marlite.com; Website: www.marlite.com.

1. Acceptable Material: Marlite® Sieva™ Large Panel Wall System.
2. Architect approved equivalent.
3. See Section 012500 - PRODUCT SUBSTITUTION PROCEDURES for Substitution Requests.

2.02 PERFORMANCE REQUIREMENTS

A. Burn Characteristics to ASTM E84, Class A.

1. Flame spread: 0-25.
2. Smoke Developed 0-450.

2.03 DESCRIPTION

A. Sieva™ Large Panel Wall System incorporating Wood Veneer and HPL.

2.04 HARDWARE

A. Panel (Reveal) Trim: Aluminum profiles in 8' lengths.

1. Reveal: (Reveal options:)
   a. Horizontal: LP552 Narrow Reveal ¼ inch.
   b. Vertical: LP552 Narrow Reveal ¼ inch.
2. Edge and Inside Corner: LP580-A Edge Receiver and LP580-B Edge Batten ½ inch
3. Outside Corner: LP560 Outside Corner ½ inch face elements.

B. Hardware and Trim Material:

1. Aluminum - Heavy weight extruded aluminum 6063-T5 alloy and factory pre-finished.
2. Exposed aluminum: Clear satin anodized.

2.05 PANELS

A. Panel Face Dimensions: Nominal 48 inches x 96 inches, 48 inches x 120 inches, and as indicated on the drawings.

B. Panel Thickness: Nominal ½ inch.

C. Wood Fiber Substrate (backerboard): Medium density wood fiberboard, 1/2 inch, conforming to ANSI A208.2, industrial-grade MDF or other wood fiber substrates 82% minimum recycled wood waste] [and having no added formaldehyde].
   1. Grain direction: Horizontal, Vertical, or as selected by the Architect..
   2. Acceptable Material: Marlite Sieva™ Large Panel Wall System or Architect approved equivalent.

D. Wood Veneer Panels: Select AA grade quality wood veneer laminated to wood fiber substrate and coated with furniture grade catalyzed finish as protective topcoat.
   1. Edges: Square cut. Panels require field kerf cut for use with LP551 Slim Reveal 1/16-inch Trim. Panels require field dado cut for use with LP552 Narrow Reveal ¼-inch Trim.
   2. Balancing Backer: Wood veneer measuring between 0.015 and 0.025 inches.
   3. Veneer Face: 0.010 to 0.015 inches with catalyzed finish of approximately 0.003 inches.
   4. Matching between panels: Manufacturer’s standard non-sequenced matching.
   5. Species and Cut: as selected by the Architect from the manufacturer's full species and cut selection.
      a. Grain direction: Vertical, as indicated on the drawings, or as selected by the Architect from the manufacturer's full offering.
   6. Finish: as indicated on the drawings or as selected by the Architect from the manufacturer's offering.
   7. Acceptable Material: Marlite Sieva™ Wood Veneer Large Panel Wall System or Architect approved equivalent.

E. High Pressure Laminate Panels: Vertical grade high pressure plastic laminate adhered to wood fiber substrate.
   1. Edges: Square cut. Panels require field kerf cut for use with LP551 Slim Reveal 1/16-inch Trim. Panels require field dado cut for use with LP552 Narrow Reveal ¼-inch Trim.
   2. Balancing Backer: Kraft paper that does not contribute to or pose additional fire hazard.
   3. Color and pattern: As selected by the Architect from the manufacturer's full species and cut offering..
   4. Acceptable Material: Marlite Sieva™ High Pressure Laminate Large Panel Wall System or Architect approved equivalent.

2.06 ACCESSORIES

A. Adhesives: Solvent based low VOC adhesive.

B. Specifier Note: Marlite Brand C109 adhesive is recommended for the installation of Sieva™. Marlite Brand C-109 adhesive is a solvent based material, and local code restrictions may require substitution. Any adhesive substitution must have the manufacturer’s approval.

C. Acceptable Material: Marlite C-109 Solvent Based Adhesive.

2.07 FABRICATION

A. Ensure framing panels, hardware and accessories are factory finished and ready to install except for field fabrication as required at work site and perimeter conditions.
   1. Refinish field cut panel edges in accordance with manufacturer’s instruction before installation.
   2. Drill corners for cut-outs 1/8-inch radius minimum.

PART 3 EXECUTION

3.01 INSTALLER

A. Use only installers who have training and experience of work similar to the work of this Section.

3.02 EXAMINATION

A. Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for framed decorative panel system installation in accordance with manufacturer's written recommendations.
   1. Visually inspect substrate in presence of Architect.
   2. Ensure substrate is smooth, sound, clean, dry, and free of contaminants and other deleterious materials.
   3. Ensure vapor barrier has been provided on exterior walls behind backing to prevent warping.
   4. Ensure backing panels are smooth, solid, and flat and that drywall joints are taped and finished.
   5. Ensure walls are primed before installation begins.
   6. Ensure mechanical, electrical, and building service or items affecting work of this section are placed and ready to receive this work.
   7. Ensure stud spacing does not exceed 24 inches.
   8. Inform Architect of unacceptable conditions immediately upon discovery.
   9. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Architect.
   10. Starting installation of framed decorative panel system implies substrate conditions are acceptable for work of this section.

B. Ensure structural walls are finished and building is completely closed with walls thoroughly dry before starting installation.

3.03 PREPARATION

A. Conditioning: Allow panels to acclimate to balanced environment in installation location for 72 hours minimum before and during installation.
   1. Maintain environmental conditions of 60° to 80° F and 35% to 55% humidity in installation location for 72 hours before and during installation.

B. Protect existing surfaces with drop cloths.

C. Except as indicated, before installing, examine panels and arrange to achieve best combination of color, pattern, texture, and grain.

D. Ensure HVAC system is operable and installation area is balanced to normal operating conditions before proceeding with installation.

3.04 INSTALLATION

A. Install framed decorative panel system in accordance with manufacturer's written recommendations.

B. Construct casework to Architectural Woodwork Institute standards, Custom grade and in accordance with Section 064100 - Architectural Wood Casework.

C. Install materials straight, plumb and level in accordance with manufacturer's written instructions.
   1. Anchor units tightly and securely in place.
   2. Cut sheets to meet existing supports.
D. Fasten supports and trim using #6 trim-head screws anchored into stud or other solid substrate at 16-inch centers.
   1. Where screws do not hit studs, fasten with adhesive in accordance with manufacturer's written recommendations.
   2. Pre-drill holes through members and fasten screw flush with flange on aluminum profile.
   3. Where necessary countersink for screw head to seat flush with flange.
E. Avoid contamination of the panel faces with adhesives, solvents, or cleaners during installation.
   1. Clean up spills immediately.

3.05 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection in accordance with Section 014500 - QUALITY CONTROL.
B. Manufacturer's Field Services: Provide manufacturer's field services consisting of product use recommendations and periodic site visits for product installation review in accordance with manufacturer's instructions.
   1. Report any inconsistencies from manufacturer's recommendations immediately to Architect.

3.06 CLEANING

A. Perform daily progress cleaning.
   1. Leave work area clean at end of each day.
B. Upon completion, remove surplus materials, rubbish, tools, and equipment.
C. Collect recyclable waste and dispose of in accordance with manufacturer's written recommendations and at appropriate recycling facilities.

3.07 PROTECTION

A. Protect installed framed decorative panel system from damage during construction.
B. Repair or replace adjacent materials damaged by installation of framed decorative panel system.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
   1. Galvanized metal.
   2. Steel.

1.03 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and not more than 10 units at 85 degrees, according to ASTM D523.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.04 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 each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Step coats on Samples 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: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
   3. VOC content.

1.05 CLOSEOUT SUBMITTALS

A. 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.

1.06 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 gal. of each material and color applied.

1.07 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
      b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
      c. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

B. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacture’s label with the following information:
   1. Product name and type (description).
   2. Batch date.
   3. Color number.
   4. VOC content.

5. Environmental handling requirements.
6. Surface preparation requirements.
7. Application instructions.

1.09 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Sherwin Williams
   2. Benjamin Moore & Co.
   3. PPG Architectural Finishes, Inc.

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in other Part 2 articles for the paint category indicated.

2.02 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

D. Colors: As selected by Architect from manufacturer's full range.

2.03 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
   1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected

materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.01 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. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
   1. Report, in writing, conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:
   1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
      a. Concrete: 12 percent.
      b. Masonry (Clay and CMU): 12 percent.
      c. Wood: 15 percent.
      d. Portland Cement Plaster: 12 percent.
      e. Gypsum Board: 12 percent.
   2. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
   3. Proceed with coating application only after unsatisfactory conditions have been corrected.
      a. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

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.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 3, "Power Tool Cleaning."
2. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
3. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view, and dust off.
3. Stain edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.03 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed to view:
    a. Equipment, including panelboards and switch gear.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Tanks that do not have factory-applied final finishes.

3.04 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING 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.

3.06 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Pigmented Polyurethane System: (MPI EXT 5.1H)
    a. Prime Coat: Alkyd anti-corrosive, quick dry for metal, MPI #79: Sherwin-Williams Kern Kromik Universal Primer, B62WZ111 Series, at 3.0 to 4.0 mils dry, per coat..

b. Intermediate Coat: Polyurethane, two component, pigmented, semi-gloss, Gloss Level 5, MPI #72: Sherwin-Williams Acrolon 218 HS Acrylic Polyurethane, B65-650 Series, at 3.0 to 6.0 mils dry , per coat.
c. Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 6), MPI #72: Sherwin Williams Acrolon 218 HS Acrylic Polyurethane, B65-600 Series, at 3.0 to 6.0 mils dry, per coat.

B. Galvanized-Metal Substrates:

1. Water-Based Light Industrial Coating System:
   a. Prime Coat: Primer, water-based, anti-corrosive for metal, MPI #107: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, 5.0 to 10.0 mils wet, 2.0 to 4.0 mils dry.
   b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
   c. Topcoat as selected by the Architect from the following:
      1) Topcoat: Light industrial coating, exterior, water based, semi-gloss, (Gloss Level 5), MPI #163: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.
   1. Concrete.
   2. Concrete Masonry Units.
   3. Steel.
   4. Galvanized metal.
   5. Gypsum board.
   6. Wood.
   7. Aluminum.

1.03 DEFINITIONS

A. Flat: Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. Matte: Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. Eggshell: Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

D. Satin: Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

E. Semi-Gloss: Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

F. Gloss: Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

G. High Gloss: Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.04 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.
   1. Product List: For each product indicated, include the following:
   2. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   3. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
   4. VOC content.

1.05 CLOSEOUT SUBMITTALS

A. Coating Maintenance manual: 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.

1.06 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 gal. of each material and color applied.

B. 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.

1.07 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

B. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer's label with the following information:

1. Product name and type (description).
2. Batch date.
3. Color number.
4. VOC content.
5. Environmental handling requirements.
6. Surface preparation requirements.
7. Application instructions.

1.09 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Lead Paint: It is not expected that lead paint will be encountered in the Work.

PART 2 - PRODUCTS

2.01 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. Benjamin Moore & Co.
2. PPG Architectural Finishes, Inc.
3. Sherwin-Williams Company.

2.02 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.

4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anti-corrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

D. Colors: As selected by Architect from manufacturer's full range.

1. 30 percent of surface area will be painted with deep tones.

2.03 BLOCK FILLERS

A. Block Filler, Latex, Interior/Exterior: MPI #4.

1. Benjamin Moore - Super Spec - Int/Ext High-Build Block Filler - 206/K206 (75-100 sq. ft. / gal - 4.2 mdf per coat), VOC 55 g/l, CHPS (E3)
2. Sherwin-Williams - PrepRite Int/Ext Block Filler, B25W25, at 75-125 sq. ft. per gal. (E3)
3. Or approved equal.

2.04 PRIMERS/SEALERS

A. Primer Sealer, Latex, Interior: MPI #50.

1. Benjamin Moore - Ultra Spec 500 Latex Primer N534 (0 g/l), 50 X-Green (E3)
2. Sherwin-Williams - Pro Mar 200 Zero - Interior Latex Primer - B28W02600/B28WQ2600 (E3)
3. PPG - Speedhide Interior Latex - Quick-Drying #6-2 (E3)

B. Primer Sealer MPI #60.

1. Benjamin-Moore - (E3) Insul-X Tough Shield Floor and Patio TS-3 (<200 g/l)
2. Sherwin-Williams - Protective & Marine - Armorseal Tread-Plex - B90W111 (E3)
3. Or approved equal.

C. Primer Sealer, Interior, Institutional Low Odor/VOC: MPI #149.

1. Benjamin Moore - Ultra Spec 500 Latex Primer N534 +(0 g/l), MPI 149 X-Green (E3)
2. Sherwin-Williams - ProMar 200 Zero - Interior Latex Primer - B28W02600/B28WQ2600 (E3)
3. PPG - Speehide Zero Interior Zero VOC - #6-4900XI -(E3)

D. Primer, Latex, for Interior Wood: MPI #39.

1. Benjamin Moore - Fresh Start N023 Primer, CHPS Certified (E3)
2. Sherwin-Williams - PrepRite ProBlock Primer Sealer - B51-620 Series, at 4.0 mils wet, 1.4 mils dry. (E3)
3. Or approved equal.

E. Primer, Alkyd, Anti-Corrosive, for Metal: MPI #79.

1. Benjamin Moore - Super Spec Alkyd Metal Primer P06, 1.9 mdf, VOC - 313 (E2)
2. Sherwin-Williams - Protective & Marine - Kem Bond HS - B50WZ4 (E2)
3. Rustoleum - High Performance - 7400 System - #2082402 (E2)
4. Or approved equal

F. Primer, Alkyd, Quick Dry, for Metal: MPI #76.

1. Benjamin Moore -Corotech Universal Metal Primer V131, 2.1 mdf, 333 g/l.
2. Sherwin-Williams - Protective & Marine - Kem Bond HS Universal Alkyd Primer - B50WZ0004 (E3)
3. Or approved equal.

G. Primer, Galvanized, Water Based: MPI #134.

1. Benjamin Moore Super Spec HP Acrylic Metal Primer P04/KP04.
2. Sherwin Williams - Pro Industrial - Pro-Cryl Universal Primer - B66W310 (E2)
3. Or approved equal.

2.05 WATER-BASED PAINTS

A. Latex, Interior, Flat, (Gloss Level 1): MPI #53.

1. Benjamin Moore - Eco Spec WB Interior Latex Flat Finish N373/F373 (E3)
2. Sherwin-Williams - Solo - Interior/Exterior 100% Acrylic Flat - A74W00051 (E3)
3. PPG - Speedhide - Interior Flat Latex - #6-70 (E3).
4. Or approved equal.

B. Latex, Interior, (Gloss Level 4): MPI #43 (Pearl / Satin / Low Lustre)

1. Benjamin Moore - Ultra Spec 500 Latex Semi Gloss N539 (0 g/l), 43 X-Green (E3).
2. Sherwin-Williams - ProMar 200 Zero VOC - Interior Latex Semi-Gloss, B31-2600 Series - (E3).
3. Or approved equal.

C. Latex, Interior, Institutional Low Odor/VOC, Flat (Gloss Level 1): MPI #143.

1. Benjamin Moore - Ultra Spec 500 Latex Eggshell N538 (0 g/l), MPI #143 X-Green, CHPS Certified (E3).
2. Sherwin-Williams - Harmony - Interior Acrylic Latex Flat - B05W01051 (E3)
3. Or approved Equal.

D. Latex, Interior, Institutional Low Odor/VOC, (Gloss Level 3): MPI #145

1. Benjamin Moore - Ultra Spec500 Latex Eggshell N538 (0 g/l), MPI # 145 X-Green, CHPS Certified (E3).
2. Sherwin Williams Promar 200 Zero VOC - Interior Latex Flat - #B30WO2651/B30WQ2651 (E3).
3. PPG Speedhide Zero - Interior Zero VOC Latex Flat - #6-4110XI (E3).

E. Latex, Interior, High Performance Architectural, (Gloss Level 2): MPI #138.

1. Benjamin Moore Regal Select Waterborne Interior Paint - Eggshell Finish 549, 1.5 mdf, (0 g/l), MPI #138 X-Green, CHPS Certified.
2. Sherwin-Williams - SuperPaint - Interior Latex Satin - A87W001151/A87WQ1151 (E3)
3. Or approved equal.

2.06 SOLVENT-BASED PAINTS

A. Epoxy Primer MPI #212

1. Sherwin-Williams - Protective & Marine - ArmorSeal 33 Epoxy Primer - B58AQ33/B60VQ33 (E3)
2. Or approved Equal

B. Alkyd, Quick Dry, Semi-Gloss (Gloss Level 5): MPI #81.

1. Corotech Alkyd Enamel Semi-Gloss V231, 2.0 - 2.5 mdf, 389 g/l.
2. Or approved equal.

PART 3 - EXECUTION

3.01 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. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
   1. Report in writing conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:
   1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
      a. Concrete: 12 percent.
      b. Masonry (Clay and CMU): 12 percent.
      c. Wood: 15 percent.
      d. Gypsum Board: 12 percent.
   2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

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 substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
   1. Concrete Floors: Remove oil, dust, grease, dirt and other foreign materials. Comply with SSPC-SP-13/NACE 6 or ICRI 03732.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
   1. SSPC-SP 3, "Power Tool Cleaning."

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
   1. SSPC-SP 2, "Hand Tool Cleaning."
   2. SSPC-SP 3, "Power Tool Cleaning."
   3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
   4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections and abraded areas of shop paint and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop primed surfaces.

H. Galvanized Metal Surfaces: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:
   1. Scrape and clean knots and apply coat of knot sealer before applying primer.
   2. Sand surfaces that will be exposed to view and dust off.
   3. Prime edges, ends, faces, undersides and backsides of wood.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt and other foreign material that might impair the bond of paints to substrates.

3.03 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Unless otherwise specified or noted, paint all “unfinished” conduits, piping, hangers, ductwork and other mechanical and electrical equipment with color and texture to match adjacent surfaces, in the following areas:
    a. where exposed-to-view in all exterior and interior areas.
    b. in all interior high humidity interior areas.
    c. in all boiler room, mechanical and electrical rooms.
2. In unfinished areas leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
3. Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
4. Do not paint over nameplates.
5. Paint the inside of all ductwork where visible behind louvers, grilles and diffusers for a minimum of 460 mm (18”) or beyond sight line, whichever is greater, with primer and one coat of matt black (non-reflecting) paint.
6. Paint the inside of light valances gloss white.
7. Paint disconnect switches for fire alarm system and exit light systems in red enamel.
8. Paint red or band all fire protection piping and sprinkler lines in accordance with mechanical specification requirements and the AHJ. Keep sprinkler heads free of paint.
9. Paint yellow or band all natural gas piping in accordance with mechanical specification requirements and the AHJ.
10. Backprime and paint face and edges of plywood service panels for telephone and electrical equipment before installation to match adjacent wall surface. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
    a. Uninsulated plastic piping.
    b. Pipe hangers and supports.
    c. Metal conduit.
    d. Plastic conduit.
    e. Tanks that do not have factory-applied final finishes.
    f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material. Coordinate the installation of required piping labels with the installing contractor in order to schedule painting prior to application of labels.
11. Paint the following work where exposed in occupied spaces:
    a. Equipment, including panelboards.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.

g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Other items as directed by Architect.

12. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.04 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 PROTECTION

A. Protect all exterior surfaces and areas, including landscaping, walks, drives, all adjacent building surfaces (including glass, aluminum surfaces, etc.) and equipment and any labels and signage from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.

B. Protect all interior surfaces and areas, including glass, aluminum surfaces, etc. and equipment and any labels and signage from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.

C. Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

3.06 CLEANING

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site. Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.

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. Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.07 INTERIOR PAINTING SCHEDULE

A. Concrete and Clay Masonry Substrates, Non-traffic Surfaces:

1. Institutional Low-Odor/VOC Latex System: (MPI INT 3.1M).
    a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149. Benjamin Moore - Ultra Spec 500 Latex Premier N534 (0 g/l), MPI #50 X-Green (E3)
    b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat
    c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3), MPI #145 X-Green. Benjamin Moore - Ultra spec 500 Latex Egg shell, N 538 (0 g/l).

B. Concrete Substrates, Traffic Surfaces:

1. Latex Floor Enamel System: (MPI INT 3.2A)
    a. Prime Coat: Floor paint, latex, slip-resistant, matching topcoat.
    b. Topcoat: Floor paint, latex slip-resistant, low gloss (maximum Gloss Level 3), MPI #60: Benjamin Moore - Insl-X Tough Shield Floor and Patio TS-3 (<200 g/l).
2. Clear Acrylic System, Gloss Finish: (MPI INT 3.2F)
    a. First Coat: MPI #99 - Sherwin -Williams - H&C Concrete Sealer Wet Look Water Base, at 100 to 200 sq. ft. per gal (2.4 to 4.9 sq. m per l).
    b. Second Coat: MPI #99 - Sherwin-Williams - H&C Concrete Sealer Wet Look Water Base, at 100 to 200 sq. ft. per gal (2.4 to 4.9 sq. m per l).
3. Concrete Stain System (Water-based): (MPI INT 3.2E)
    a. First Coat: Benjamin Moore - Insl-X Tuffcrete Waterborne Acrylic Concrete Stain CST-2xxx, 450-500 sq. ft. / gal., 153 g/l, MPI #58.
    b. Second coat: Benjamin Moore - Insl-X Tuffcrete Waterborne Acrylic Concrete Stain CST-2xxx, 450-500 sq. ft. / gal., 153 g/l, MPI #58.
4. Concrete Substrates, Non-Slip - High Performance Traffic Surfaces: (MPI INT 3.2L)
    a. Pigmented Polyurethane over Epoxy Slip-Resistant Deck Coating System:
        1) Prime Coat: Epoxy, gloss , (Gloss Level 6), MPI #212: S-W Armorseal 1000 HS, B67W2001 Series, at 2.5 to 4.0 mils dry, per coat.
        2) Intermediate: Polyurethane, gloss matching topcoat.
        3) Topcoat: Polyurethane, two-component, pigmented, gloss, (Gloss Level 6), MPI #212: S-W Armorseal HS Polyurethane, B65W220 Series, at 2.0 to 3.0 mils dry, per coat, with manufacturer's recommended slip-resistant aggregate.

C. CMU Substrates

1. High-Performance Epoxy Paint System: (MPI INT 4.2G)
    a. Block Filler: Block filler, epoxy, MPI #116: S-W Kem Cati-Coat HS Epoxy Filler/Sealer, at 10 to 20 mils dry, per coat.
    b. Intermediate Coat: Epoxy, high-build, low gloss, MPI #108: S-W Macropoxy 646 Fast Cure Epoxy, B58 Series, at 5 to 10 mils dry, per coat.
    c. Topcoat: Polyurethane, two-component, pigmented, semi-gloss, (Gloss Level 5), MPI #72: S-W Acrolon 218 HS Acrylic Polyurethane, B65-650 Series, at 3.0 to 6.0 mils dry, per coat.
2. Water-Based Light Industrial Coating System: (MPI INT 4.2K)
    a. Block Filler: Benjamin Moore Super Spec Masonry Int/Ext High Build Block Filler 206, 75-100 sq. ft. /gal., 8.5-11.4 mdf, 45 g/l, MPI#4, CHPS Certified.
    b. Intermediate Coat: Light industrial coating, interior, water-based, matching Topcoat.
    c. Topcoat: Light Industrial coating, interior, water-based, eggshell, (Gloss Level 5), MPI #153 X-Green: Benjamin Moore Ultra Spec HP DTM Acrylic Enamel Semi-Gloss HP29, 2.3 mdf, VOC-45.
3. Latex System: (MPI INT 4.2A)
    a. Block Filler: Latex Block Filler, MPI #4 X-Green: Benjamin Moore Super spec Masonry Int/Ext High Build Block Filler 206, 75-100 sq. ft. / gal., 8.5-11.4 mdf

b. Intermediate coat: Latex interior, matching topcoat.
c. Topcoat: Latex, interior flat (Gloss Level 2), MPI #44 X-Green / #144 X-Green: Benjamin Moore - Ultra Spec 500 Interior Low Sheen Finish N537, 1.8 mdf, (0 g/l), CHPS Certified.

D. Metal Substrates:

1. Latex System: (MPI INT 5.1Q)
   a. Prime Coat: Primer, rust-inhibitive, water-based, MPI #107: Benjamin Moore Super Spec Acrylic Metal Primer P04, 2.0 mdf, VOC-47, CHPS Certified.
   b. Intermediate Coat: Water-based acrylic interior, matching Topcoat.
   c. Topcoat: Water based acrylic, gloss (Gloss Level 5), MPI #147 X-Green: Benjamin Moore Ultra Spec 500 Interior Gloss finish N540, 1.8 mdf, (0 g/l), CHPS Certified.
2. Water-Based Dry-Fall System: (MPI INT 5.1C)
   a. Two Top Coats: Dry-fall latex, flat, MPI #118: Benjamin Moore - Coronado Super Kote Flat Latex dry Fall N110, 1.1-1.7 mdf, 375-475 sq. ft. / gal., (46 g/l), CHPS Certified.
3. Pigmented Polyurethane over Epoxy System: (MPI INT 5.1H)
   a. Prime Coat: Epoxy, high-build, low gloss, MPI #108: Benjamin Moore - Corotech Polyamide Epoxy Semi-Gloss Coating V400, 2.5-3.0 mdf, (326 g/l).
   b. Intermediate Coat: Polyurethane, two-component, pigmented, matching topcoat.
   c. Topcoat: Polyurethane, two-component, pigmented, semi-gloss, (Gloss Level 5), MPI #72: Benjamin Moore - Corotech, Alphatic Acrylic Urethane Gloss, V500, 2.5-3.6 mdf, (229 g/l).
4. Epoxy-Modified Latex System: (MPI INT 5.1K)
   a. Prime Coat: Primer, rust-inhibitive, water based, MPI #107: Benjamin Moore - Corotech Acrylic Metal Primer, V110.
   b. Intermediate Coat: Epoxy-modified latex, interior, gloss matching topcoat.
   c. Topcoat: Epoxy-modified latex, interior, gloss, (Gloss Level 6), MPI #115: Benjamin Moore - Corotech, Acrylic Epoxy Gloss, V450-90, 1.5 - 2.0 mdf, (168 g/l),
5. Acrylic/Alkyd System:
   a. Prime Coat, MPI #107: Benjamin Moore - Corotech Acrylic Metal Primer, V110,
   b. Intermediate Coat: Water-based acrylic-alkyd, interior, matching topcoat.
   c. Topcoat: Water-based acrylic-alkyd, semi-gloss, interior: Benjamin Moore Advance Waterborne Interior Alkyd Semi-Gloss N793, CHPS Certified.

E. Galvanized-Metal Substrates:

1. Pigmented Polyurethane System: (MPI INT 5.4C)
   a. Prime Coat, MPI #105: Benjamin Moore - Corotech Acrylic Metal Primer V110, 1.5 - 2.0 mdf, (VOC ,<200)
   b. Intermediate Coat: Polyurethane, two-component, pigmented, matching topcoat.
   c. Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #105: Benjamin Moore - Corotech Urethane Waterborne Urethane Gloss, V540, 470-530 sq. ft. / gal., 1.6-1.8 mdf, (19 g/l).

F. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Pigmented Polyurethane System:
   a. Prime Coat: Primer, vinyl wash: Benjamin Moore - Corotech Waterborne Bonding Primer, V175, 1.6 mdf, (84 g/l).
   b. Intermediate Coat: Polyurethane, two-component, pigmented, matching topcoat.
   c. Topcoat: Polyurethane, two-component, pigmented, gloss: Benjamin Moore - Corotech Waterborne Urethane Gloss, V540, 470-530 sq. ft. / gal., (19 g/l).

G. Wood Substrates:
   1. Water-Based Light Industrial Coating System:
      a. Prime Coat: Primer sealer, latex, interior, MPI #39: Benjamin Moore - Fresh Start N023 Primer, 1.2 mdf, (44 g/l)(E3)
      b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
      c. Topcoat: Light industrial coating, interior, water based, eggshell, (Gloss Level 3), MPI #151: Benjamin Moore - Corotech Pre-Catalyzed Waterborne Epoxy Eggshell, V342, 1.5-2.0 mdf, (VOC- 72). (E1)

H. Gypsum Board Substrates:
   1. Latex System: (INT 9.2A)
      a. Prime Coat: Primer, latex, interior, MPI #149 X-Green: Benjamin Moore - Ultra Spec 500 Latex Primer, N534 (0 g/l),
      b. Intermediate Coat: Latex, interior, matching topcoat.
      c. Topcoat: Latex, interior, flat (Gloss Level 1), MPI #53 X-Green/#143 X-Green: Benjamin Moore - Ultra Spec 500 Latex Flat N536, (0 g/l), CHPS Certified.
   2. Institutional Low-Odor/VOC Latex System: (MPI INT 9.2M)
      a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149 X- Green. Benjamin Moore - Ultra Spec 500 Latex Primer, N534, (0 g/l).
      b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
      c. Topcoat: Latex, interior, institutional low odor/VOC, flat (Gloss Level 1), MPI #143: Benjamin Moore - Ultra-Spec 500 Latex Flat, N536, (0 g/l), CHPS Certified.
   3. High-Performance Architectural Latex System: (INT 9.2B)
      a. Prime Coat: Primer sealer, latex, interior, MPI #50 X-Green. Benjamin Moore - Ultra Spec 500 Latex Primer, N534, (0 g/l),
      b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
      c. Topcoat: Latex, interior, high performance architectural, (Gloss Level 3), MPI #139: Benjamin Moore Ultra spec 500 Latex Eggshell, N538, (0 g/l), CHPS certified.
   4. Water-Based Light Industrial Coating System:
      a. Prime Coat: Primer sealer, latex, interior, MPI #50 X-Green: Benjamin Moore - Ultra Spec 500 Latex Primer, N534, (0 g/l).
      b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
      c. Topcoat: Light industrial coating, interior, water based, eggshell, (Gloss Level 3), MPI #151: Benjamin Moore - Corotech Pre-Catalyzed Waterborne Epoxy Eggshell, v342, 1.5- 2.0 mdf, (VOC-72).
   5. Epoxy-Modified Latex System: (MPI INT 9.2F)
      a. Prime Coat: Primer sealer, latex, interior, MPI #50 X-Green:Benjamin Moore - Ultra Spec 500 Latex Primer, N534, (0 g/l).
      b. Intermediate Coat: Epoxy-modified latex, interior, matching topcoat.
      c. Topcoat: Epoxy-modified latex, interior, eggshell, (Gloss Level 3), MPI #115: Benjamin Moore - Corotech Pre-Catalyzed Waterborne Epoxy Eggshell, V342, 1.5 - 2.0 mdf, (VOC-72).

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Solid-polymer toilet compartments configured as toilet compartment enclosures.
   2. Partition Style:
      a. Floor Anchored / Overhead Braced.

1.03 REFERENCES

A. ASTM B85/B85M - Standard Specification for Aluminum-Alloy Die Castings; 2018, with Editorial Revision.

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

C. ICC A117.1-2009 - Accessible and Usable Buildings and Facilities; 2009.

D. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

E. All work of this section shall conform to industry standards and/or manufacturer’s recommendations.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of cutouts for compartment-mounted toilet accessories.
   2. Show locations of reinforcements for compartment-mounted grab bars.
   3. Show locations of centerlines of toilet fixtures.

C. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection.

D. Manufacturer's Warranty: Manufacturer's standard 15 -year limited warranty for panels, doors and stiles against breakage, corrosion, delamination and defects in factory workmanship. Manufacturer's standard 1 year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.

1.05 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment, from manufacturer.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: A company regularly engaged in manufacture of products specified in this section, and whose products have been in satisfactory use under similar service conditions for not less than 5 years.

B. Installer Qualifications: A company regularly engaged in installation of products specified in this Section, with a minimum of 5 years experience.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Class A flame spread/smoke developed rating, tested to ASTM E84.

D. Material Fire Ratings:
   1. National Fire Protection Association - NFPA 286: Pass.
   2. International Code Council (ICC): Class B.

E. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and {\rs\#1} for toilet compartments designated as accessible.

1.08 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

1.09 WARRANTY

A. Manufacturer guarantees its plastic against breakage, corrosion, and delamination under normal conditions for 25 years from the date of receipt by the customer. If materials are found to be defective during that period for reasons listed above, the materials will be replaced free of charge.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials:
   1. Panels and pilasters shall be 1" thick solid HDPE resin; water resistant; non-absorbent; self-lubricating surface; covered with protective masking. Color and material - homogeneous throughout.
   2. Fire Rating:
      a. Not required.

3. Aluminum Extrusions: ASTM B221, 6463-T5 alloy and temper.
4. Stainless Steel Castings: ASTM A167, Type 304.
5. Edges: Shiplap.

2.02 SOLID-POLYMER UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Scranton Products (Basis of Design): 801 E. Corey St. ; Scranton, PA 18507; Toll Free Tel: 800-445-5148.
   2. ASI Global.
   3. Bradley Corporation.

B. Toilet Enclosure Style: Floor Anchored/Overhead Braced.

C. Entrance-Screen Style: Floor Anchored/Overhead Braced.

D. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE)or panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges, no-sightline system, and with homogenous color and pattern throughout thickness of material.
   1. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum strip fastened to exposed bottom edges of solid-polymer components to prevent burning.
   2. Color, Texture and Patterns: Colors, Textures and Patterns in each room as selected by Architect from manufacturer's full range.

E. Pilaster Shoes and Sleeves (Caps):
   1. Three Inch high manufacturer's standard design; 14 gauge, Type 304 stainless steel secured to pilaster with stainless steel tamper-resistant Torx head sex bolt.
   2. Three inch high manufacturer's standard design Polymer Color and Pattern: Matching or Contrasting with pilaster, as selected by Architect from manufacturer's full range.

F. Brackets (Fittings):
   1. Full-Height (Continuous) Type:
      a. Polymer as indicated on the drawings.
         1) Polymer Color, Texture and Patterns: Matching or Contrasting with panel, as selected by the Architect from the manufacturer's full color offering.
      b. Extruded heavy-duty aluminum 6463-T5 alloy as indicated on the drawings.
      c. Stainless steel, Type 304 as indicated on the drawings.
   2. The brackets are fastened to the pilaster with stainless steel tamper resistant Torx head screws and fastened to the panels with stainless steel tamper resistant Torx head sex bolts.

G. Door Hardware:
   1. Continuous aluminum.
   2. Continuous stainless steel helix.
   3. Continuous stainless steel spring hinge.
   4. Vault Hinge: Heavy-duty diecast vault zamac hinge shall have gravity-acting cams and are fabricated from a die cast aluminum alloy with a brushed finish and wrap around flanges. The cam is constructed from ¾” diameter nylon rod and a 3/8” stainless steel pin.
   5. Integral Hinges (Stealth): Hinges shall be integral, fabricated in the door and pilaster with no exterior exposed metal parts. Hinges operate with field adjustable nylon cams. Cams can be field adjusted to any degree.
   6. Wrap-Around Hinges: Hinges shall be 8 inches (203 mm) and fabricated from heavy-duty extruded aluminum wrap-around hinges through-bolted to pilasters and doors with stainless

steel tamper resistant Torx head sex bolts. Hinges operate with field adjustable nylon cams. Cams can be field set in 30, 60 or 90-degree increments.

7. Wrap-Around Hinges (Regal): Hinges shall be fabricated from heavy-duty cast aluminum, wrap around flanges through bolted to doors and pilasters. Hinges operate with field adjustable nylon cams. Cams can be field set in 30, 60 or 90-degree increments.
8. Latches:
    a. Aluminum Slide Bolt Latch and housing shall be made of heavy-duty extruded aluminum (6463-T5 alloy). The latch housing shall have a bright dip anodized finish, and the slide bolt and button shall have a black anodized finish.
    b. Aluminum Paddle Latch and housing shall be made of heavy-duty extruded aluminum (6463-T5 alloy). The latch housing and paddle shall have a bright dip anodized finish.
    c. Stainless Steel Slide Bolt Latch and housing shall be made of heavy-duty stainless steel type 304. The latch housing shall have a bright finish, and the slide bolt and button shall have a black anodized finish.
    d. Stainless Steel Paddle Latch and housing shall be made of heavy-duty stainless steel type 304. The latch housing and paddle shall have a bright finish.
    e. Provide occupancy indicator.
9. Door strike/keeper shall be made of heavy-duty extruded aluminum (6436-T5 alloy) with a bright dip anodized finish and secured to the pilasters with stainless steel tamper resistant Torx head sex bolts. Bumper shall be made of extruded black vinyl.
    a. Style: 3 inches (76 mm) stainless steel emergency access.
10. Each door shall be supplied with one coat hook/bumper and door pull made of chrome plated Zamac.
11. Equip outswing handicapped doors with second door pull and door stop.

2.03 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Clear anodized aluminum.
2. Hinges: Manufacturer's standard paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees. Note: Door hardware shall enable emergency access form the exterior of the toilet stall unit for emergency access purposes.
3. Latch and Keeper: Manufacturer's standard latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors and entrance-screen doors.
6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, heavy-duty extruded aluminum (6463-T5 alloy) head rail with anti-grip profile and in manufacturer's standard finish shall be fastened to the headrail bracket by a stainless steel tamper resistant Torx head sex bolt, and fastened at the top of the pilaster with stainless steel tamper resistant Torx head screws.

1. Headrail brackets shall be 20 gauge stainless steel with a satin finish and secured to the wall with a stainless steel tamper resistant Torx head screws.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

1. Masonry Anchors: Type H/S Drop-In Anchors by the Rawlplug Co., Inc., New Rochelle, NY 10802.

2.04 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch (610-mm) wide, in-swinging doors for standard toilet compartments and 36-inch (914-mm) wide, out-swinging doors with a minimum 32-inch (813-mm) wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Examine areas to receive toilet partitions, screens, and shower compartments for correct height and spacing of anchorage/blocking and plumbing fixtures that affect installation of partitions. Report discrepancies to the architect.

3.02 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:
   a. Pilasters and Panels: 3/8 inch (9.5 mm).
   b. Panels and Walls: 1 inch (25 mm).
2. No evidence of cutting, drilling, and/or patching shall be visible on the finished work.
3. Finished surfaces shall be cleaned after installation and be left free of imperfections.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with

no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches (51 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.03 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors in closed position when unlatched. Set hinges on out-swinging doors and doors in entrance screens to return doors to fully closed position.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Replace all damaged products including adjacent finish surfaces before Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Public-use washroom accessories.
   2. Miscellaneous Bathroom Accessories
   3. Public-use shower room accessories.
   4. Underlavatory guards.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.

1.04 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty requirements listed under this section.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals. Manufacturer's service and parts manual shall be provided to the owner upon completion of project.

B. All keyed toilet accessories shall be keyed alike. Six keys shall be provided to the Owner.

1.06 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 back-up construction as required to prevent delaying the Work.

1.07 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion for Toilet Accessories and Hand Dryer units. Mirror reflective surfaces shall be warranted for a period of 15 years against silver spoilage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Stainless Steel: ASTM A666/A666M, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated. 65-70% post-recycled content.

B. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 (Z180) hot-dip zinc coating.

C. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

D. 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.

E. Mirrors: ASTM C1048, Tempered Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.02 WASHROOM ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Bobrick Washroom Equipment, Inc.
2. American Specialties, Inc.
3. Bradley Corporation

B. Toilet Tissue (Roll) Dispensers: (AC-03

1. Basis-of-Design Product: Bobrick Model B-4288 - Contura Series.
   a. Description: Double-roll dispenser
   b. Mounting: Surface mounted.
   c. Operation: Unit shall be equipped with two theft-resistant, heavy-duty, one-piece, Theft-resistant molded ABS spindles.
   d. Capacity: Designed for up to 5 1/8 inch- diameter tissue rolls.
   e. Material and Finish: Type 304 Stainless steel, No. 4 finish (satin).
   f. Lockset: Tumbler type. Keyed alike to all other Toilet Accessories.
   g. Refill Indicator: Pierced slots at front.

C. Toilet Tissue (Roll) Dispensers: <>

1. Basis-of-Design Product: Bobrick Model B-2892.
   a. Description: Jumbo Double-roll dispenser
   b. Mounting: Surface mounted.
   c. Operation: Unit shall be equipped with two theft-resistant, heavy-duty, one-piece, Theft-resistant molded ABS spindles.
   d. Capacity: Designed for up to 10 inch- diameter tissue rolls with 3 inch diameter core.

e. Material and Finish: Type 304 Stainless steel, No. 4 finish (satin).
f. Lockset: Tumbler type. Keyed alike to all other Toilet Accessories.
g. Refill Indicator: Pierced slots at front.

D. Combination Towel Dispenser/Waste Receptacles: <>

1. Basis-of-Design Product: Bobrick Model B-3942.
   a. Description: Semi-recessed convertible unit for dispensing paper towels, with removable waste receptacle. Paper towel dispenser shall dispense 600 C-fold or 800 multi-fold towels. Cabinet shall be 18-8, type 304 heavy gauge stainless steel, welded construction with satin finish.
   b. Flange, Skirt and Door shall be fabricated from 18-8, type 304, 22 gauge stainless steel with satin finish. Door shall have double pan back construction.
   c. Mounting: Semi-recessed mounted. Provide one piece beveled flange stainless steel finishing collar in depth required by wall construction.
   d. Door shall be mounted with full-length stainless steel piano hinge.
   e. Minimum Waste Receptacle Capacity: 12 gal. (45.4 L) with all handling edges hemmed for safe handling.
   f. Material and Finish: Type 304 Stainless steel, No. 4 finish (satin), welded construction.
   g. Liner: Reusable, vinyl waste-receptacle liner.
   h. Lockset: Tumbler type for towel dispenser compartment and waste receptacle. Keyed alike to all other locking toilet accessories.

E. **Liquid-Soap Dispensers**: (AC-02) <>

1. Basis-of-Design Product: Bradley Verge Soap Dispensers
   a. Deck Mounted Soap Dispensers – General:
      1) Touch free infrared sensor-operated.
      2) Multi-station system shall supply up to six soap dispensers.
      3) Compliance and Certifications:
         (a) ADA / ICC ANSI A117.1, Citation 609.4.
         (b) UL electrical components.
         (c) CE electrical components.
   b. Vandal-resistant construction shall include concealed sensor package, durable finish, and rotation resistant gasket/washer.
   c. Chrome Finish: “PC” Polished Chrome.
   d. Physical Vapor Deposition (PVD) Finish: “BB” Brushed Black Stainless.
   e. Physical Vapor Deposition (PVD) Finish: “BS” Brushed Stainless.
   f. Physical Vapor Deposition (PVD) Finish: “BZ” Brushed Bronze.
   g. Physical Vapor Deposition (PVD) Finish: “BR” Brushed Brass.
   h. Physical Vapor Deposition (PVD) Finish: “BN” Brushed Nickel.
2. Sensored Soap Dispenser [SD#BS]: Deck-mounted, sensor-operated, cast brass, with LED battery and soap level indicators, [with battery box and batteries. 70.5 oz (2080 mL) capacity bottle.][with single dispenser 120VAC powerpack. 70.5 oz (2080 mL) capacity bottle.][with maximum of 6 dispenser 120VAC powerpack. Multi-feed Tank: 166.5 oz (5026 mL).]
   a. Basis of Design Manufacturer/Model: Bradley Verge Deck-Mounted Soap Dispenser, Metro Series, Model 6-3300.

F. Grab Bars: (AC-04) (AC-05) (AC-06)

1. Basis-of-Design Product: Bobrick Model B-6806-Series.
   a. Mounting: Flanges with concealed vandal resistant fasteners.
   b. Material: 18-8, Type 304, 18 gauge stainless steel, 0.05 inch thick.

c. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant, satin-finish texture in grip area.
d. Outside Diameter: 1-1/2 inches (38 mm).
e. Configurations and Lengths: As indicated on Drawings. Bar ends are heliarc welded to concealed mounting flanges shall be 1/8 inch thick 18-8 Type 304, 11 gauge stainless steel plate, 2 inches x 3-1/8 inches, and equipped with two screw holes for attachment to wall. Intermediate Flanges are 18-8, Type 304, 22 gauge, 2 5/8 inches x 3 1/8 inches wide by 3 1/8 inches in diameter. Flange covers shall be 22 gauge, 3-1/4 inches diameter x 1/2 inch deep drawn stainless steel with satin finish, and shall snap over mounting flange to conceal mounting screws and/or WingIt (TM) fasteners as required by wall construction. Ends of grab bar shall pass through concealed mounting flanges and be heliarc welded to form one structural unit. Clearance between the grab bar and wall shall be 1-1/2 inches.
f. Grab bars shall comply with barrier-free accessibility guidelines (including ADAAG and ICC A117.1) for structural strength and configurations.

G. Napkin / Tampon Vendor: <>

1. Basis-of-Design Product: Bobrick Model No. B-47069 25 (25 cent single coin operation) - Contura Series.
2. Type: Sanitary napkin and tampon dispenser.
3. Door: 18-8, Type 304, 18 gauge stainless steel with sating finish. Secured to cabinet with full-length stainless steel piano hinge. Door is equipped with two tumbler locks keyed alike to other accessories. Door is Drawn, one-piece, seamless construction with rounded corners and radii on edges.
4. Mounting: Surface mounted.
5. Mounting height: as indicated on the drawings or as required to meet ADA requirements.
6. Size: 14 1/2 inches wide x 28 1/2 inches high x 7 1/8 inches deep
7. Capacity: Holds 30 Tampons, 20 Napkins.
8. Operation: 25 (25 cent single coin operation).
9. Product Tray: Impact-resistant PC-ABS.
10. Exposed Material and Finish: Type 304, 18-8 Stainless steel, No. 4 finish (satin).
11. Lockset: Two flush Tumbler type door locks keyed alike with separate lock and key for coin box management access.

H. Sanitary-Napkin Disposal Units <>:

1. Basis-of-Design Product: Bobrick Model B-270 - Contura Series.
   a. Mounting: Surface mounted.
   b. Door or Cover: Drawn, one-piece construction secured with a continuous piano hinge.
   c. Receptacle: 1.0 gallon capacity.
   d. Material and Finish: 18-8, type 304, 22 gauge Stainless steel, No. 4 finish (satin).

I. Mirror Units: (AC-07)

1. Basis-of-Design Product: Bobrick Model B-2908 Series (Tempered Glass Surface).
   a. Frame: Type 304 Stainless-steel angle, 0.05 inch (1.3 mm) thick .Mirror shall have a one-piece, type-304 stainless steel angle frame, 3/4 inch x 3/4 inch (19 x 19mm) with continuous integral stiffener on all sides and beveled front to hold frame tightly against mirror. All exposed surfaces shall have satin finish with vertical grain
      1) Corners: Heliarc Welded and ground smooth.
   b. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

1) One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
2) Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

c. Size: 18 inches wide x 36 inches high and as indicated on the Drawings with mounting height to reflective surface at 40 inches above finish floor for ADA accessible lavatories.
d. All mirror edges shall be protected by plastic filler strips and the back shall be protected by full-size, shock-absorbing, water-resistant, nonabrasive, 3/16 inch (5mm) thick polyethylene padding.
e. Mirror: 1/4 inch tempered glass mirror with galvanized steel back.

2.03 MISCELLANEOUS BATHROOM ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Bobrick Washroom Equipment, Inc.
2. Bradley Corporation.

B. Shower Curtain Rod: (AC-10

1. Basis-of-Design Product: Bobrick B-6107 series with lengths as required by each shower / Tub location as indicated on the drawings.
2. Description: 1 inch (6107) OD; fabricated from nominal 0.03 inch (6107) thick stainless steel.
3. Mounting Flanges: Stainless-steel flanges designed for concealed fasteners.
4. Finish: No. 4 (satin).

C. Shower Curtain: (AC-10

1. Basis-of-Design Product: Bobrick 204 Series. Provide widths and multiples as required for each Tub/ Shower unit indicated on the drawings.
2. Size: Minimum 12 inches (305 mm) wider than opening by 72 inches (1828 mm) high.
3. Material: Vinyl, minimum 0.008 inch (0.20 mm) thick, opaque, matte.
4. Color: White.
5. Grommets: Corrosion resistant at minimum 6 inches (152 mm) o.c. through top hem.
6. Shower Curtain Hooks: Bobrick B-204-1 stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate the various sizes of Tub/ Shower units indicated on the drawings. Provide one hook per curtain grommet.

D. L-Shaped Folding Shower Seat: (AC-09)

1. Basis-of-Design Product: Bobrick; B-5181 or Architect approved equivalent.
2. Configuration: L- shaped seat. Reversible.
3. Seat: 1/2 inch thick Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, No. 4 finish (satin) Insert description.
5. Dimensions: 33 inches wide, 20 15/16 inch and 14 7/16 inch depths from wall.
6. Set seat at 17 to 19 inches above finish floor.

E. Heavy-Duty Clothes Hooks: <>

1. Basis of Design Product: Bobrick B-2116 or Architect approved equivalent.
2. One piece Brass casting with Satin nickel plated finish to match stainless steel.
3. Concealed mounting with three stainless steel set screws.
4. 300 # downward force capacity.
5. Unit projects 3 7/16 inches (Bobrick) from wall.

6. Flange diameter: 2 3/4 inches.

F. Soap Dish: <>

1. Basis of Design Product: Bobrick B-4380 (Satin-finish Stainless Steel) or Architect approved equivalent.
2. Flange diameter: 2 3/4 inches.
3. Description: Recess-Mounted Soap Dish; 18-8, Type 304, 19 gauge drawn and beveled one-piece seamless stainless steel construction with two countersunk mounting holes. 22 gauge stainless steel retaining lip in matte stainless steel finish. Units shall have raised dimple pattern to support soap bars.
4. Provide fasteners appropriate to the type of wall construction (i.e.: 1/8 inch Toggle or expansion bolts).
5. Inside dimensions: 5 5/8 inches wide x 3 5/8 inches height x 1/8 inch projection from wall.
6. Outside Frame dimensions: 7 3/16 inches wide x 5 inches height x 2 3/4 inches deep.

2.04 WARM-AIR DRYERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Excel Dryer Inc.
2. Architect approved equivalent.

B. Warm Air Hand Dryers (AC-01):

1. Basis-of-Design Product: Excel Dryer - XLERATOR warm air, rapid drying, energy efficient electric hand dryer. 1.1 noise reduction nozzle reducing air deflection noise and decibel level by 9db.
   a. Nominal Size: 11-3/4 inches wide by 12-11/16 inches high by 6-11/16 inches deep.
   b. Mounting: Provide Model 40502 recess accessory for ADA compliant surface mounted hand dryers(to provide less than 4 inch projection). Unit Size: 14 3/8 inch wide x 24 1/8 inch height x 3 1/8 inch deep recess with 1/4 inch deep flange. Overall size: 16 3/8 inch wide x 26 inch height x 3 3/8 inch deep. Mount bottom of recess 10 inches below dryer mounting height.
   c. Operation: Electronic-sensor activated when hands are held under the air-outlet opening and across path of sensor. Dryer stops when hands are removed from the sensor path. Dryer operates only when drying is taking place. Shut-off within 2 seconds when hands removed or in 35 seconds if hands not removed.
   d. Combination Motor and Blower: Series commutated, through-flow discharge, vacuum type; 5/8 HP, up to 24,000 RPM. Air flow rate: 19,000 linear feet per minute (97 meters per second) at air outlet, 16,000 linear feet per minute (81 meters per second) at average hand position of 4 inches (102 mm) below air outlet.
   e. Filtration Kit: Provide HEPA Filtration System - removes 99.999% of viruses and 99.97% of potential present bacteria at 0.3 microns from the airstream.
   f. Heater: Nichrome wire element, mounted inside blower housing to be vandal proof.
   g. Heater Safeguard: Automatic resetting thermostat to open when air flow is restricted and close when air flow is resumed.
   h. Mount dryer at a height to comply with ADA requirements for operation (48 inches for adults (Universal Design), 40 inches for children (ages 5-8) and 44 inches for children (ages 9 to 12). Install utilizing ADA-Compliant Recess Kit No. 40502 noted above.
   i. Cover Material and Finish: SB - Brushed Stainless Steel.

j. Electrical Requirements: 110-120V, 11.3 - 12.2A, 1240 - 1450W (Heat); 4.3 - 4.5A (No Heat), 460-530W (No Heat), 50/60 Hz
k. Warranty: Seven (7) -year Limited warranty.

C. Warm Air Hand Dryers <>:

1. Basis-of-Design Product: Excel Dryer -Surface-mounted, Automatic, Sensor-operated THINAIR warm air hand dryer with rapid drying (14 seconds), energy efficient electric hand dryer. 66-74 dB(a) sound levels when in use.
   a. Nominal Size: 9 5/32 inches wide by 13-15/16 inches high by 3-15/16 inches deep.
   b. Mounting: Surface mounted. Provide optional 89W (White) Microban Anti-microbial Wall Guard.
   c. Operation: Electronic-sensor activated when hands are held under the air-outlet opening and across path of sensor. Dryer stops when hands are removed from the sensor path. Dryer operates only when drying is taking place. Shut-off within 2 seconds when hands removed or in 35 seconds if hands not removed.
   d. Combination Motor and Blower: Series commutated, through-flow discharge, vacuum type; 1/2 HP, up to 31,000 RPM. Air flow rate: 18,000 linear feet per minute (91.44 meters per second) at air outlet, 16,000 linear feet per minute (81 meters per second) at average hand position of 4 inches (102 mm) below air outlet.
   e. Filtration Kit: Provide HEPA Filtration System - removes 99.999% of viruses and 99.97% of potential present bacteria at 0.3 microns from the airstream.
   f. Heater: Nichrome wire element, mounted inside blower housing to be vandal proof.
   g. Heater Safeguard: Automatic resetting thermostat to open when air flow is restricted and close when air flow is resumed.
   h. Mount dryer at a height to comply with ADA requirements for operation (48 inches for adults (Universal Design), 40 inches for children (ages 5-8) and 44 inches for children (ages 9 to 12). Install utilizing ADA-Compliant Recess Kit No. 40502 noted above.
   i. Cover Material and Finish: ABS - White ABS Polymer.
   j. Electrical Requirements: 110-120V, 7.0-7.8AA, 750-920W(Heat); / 2.9-3.4A (No Heat), 300-380W (No Heat), 50/60 Hz
   k. Warranty: Seven (7) -year Limited warranty.

2.05 UNDERLAVATORY GUARDS ___

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Truebro by IPS Corporation.
2. Or Architect approved equivalent.

B. Underlavatory Guards Supplied by Plumbing Contractor - Installed by General Contractor):<>

1. Basis-of-Design Product: TrueBro Lav-Shield.
   a. Description: Durable single piece enclosure conceals piping and valves under the lavatory, preventing direct contact with and burns from piping. Removable to allow service access.
   b. Material and Finish: Antimicrobial, molded plastic, white.

2.06 CUSTODIAL ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. American Specialties, Inc

2. Bobrick Washroom Equipment, Inc
3. Bradley Corporation.

C. Mop and Broom Holder: <>

1. Basis-of-Design Product: Bobrick Model B-224 x 36.
   a. Description: Unit with shelf, hooks, holders, and Drying rod suspended beneath shelf.
   b. Length: 36 inches (915mm).
   c. Rag Hooks: Three (3).
   d. Mop / Broom Holders: Four (4), spring-loaded, rubber hat, cam type.
   e. Drying Rod: 18-8, Type 304, 1/4 inch diameter stainless steel with satin finish.
   f. Material and Finish: 18-8, Type 304 Stainless steel, No. 4 finish (satin).
   g. Shelf: 18-8, Type 304, 18 gauge (1.2mm) thick stainless steel with satin finish. Shelf shall have a 1 1/2 inch return edge. Provide with Two (2) welded brackets of matching material.

2.07 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to the Owner's Construction Representative with a transmittal copy to the Architect.

PART 3 - EXECUTION

3.01 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 (1112 N), when tested according to ASTM F446.

3.02 TOLERANCES

A. Maximum Variation from Position: 1/8 inch (3 mm).

B. Maximum Variation from Level: 1/16 inch (1.5 mm) over length of unit.

C. Maximum Variation from Plumb: 1/16 inch (1.5 mm) over height of unit.

3.03 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 recommendations.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Fire-rated fire-protection cabinets for the following:
      a. Portable fire extinguishers.
   2. Fire Company Key Box.

1.03 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 recessed-, semi-recessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.05 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths and required blocking provisions.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

B. ADA compliant with less than 4 inch projection into corridors.

2.02 FIRE-PROTECTION CABINETS

A. Cabinet Type: Suitable for fire extinguisher.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. JL Industries, Inc.; Embassy Fire-FX2, Model 5614VFX (Basis of Design).
      b. Larsen's Manufacturing Company.
      c. Potter Roemer LLC.

B. Cabinet Construction: ASTM E814, Fire rated for one or two hours with fire-resistant liner. Rating as required by wall type.

C. Cabinet shall have reinforced corner trims and factory -supplied anchoring devices as required for the fire rating.

D. Cabinet Series: EMBASSY SERIES - TRIMLESS DECORATIVE

E. Tub Material: Cold rolled steel (standard) with Black powder-coat finish. Provide 5/8" minimum fire resistant barrier material between double wall constructions.

F. Recessed Frameless Cabinet Door: Flush, one-piece combination trim and perimeter door frame with 7/8" thick return to wall surface.

G. Door Material: Powder-coat paint steel sheet with white finish. Powder-coat paint steel sheet with white finish.

H. Door Style: V: Vertical Duo; concealed pull

I. Door Glazing: Type 17: Clear tempered glass.

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide concealed door pull and friction latch as per manufacturer's standards and as selected or indicated on the drawings.
2. Provide manufacturer's standard hinge permitting door to open 180 degrees.

K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
    a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
        1) Location: Applied to cabinet door.
        2) Application Process: Pressure-sensitive vinyl letters.
        3) Lettering Color: Red.
        4) Orientation: Vertical.

2.03 FIRE COMPANY KEY ACCESS UNIT

A. KNOX-BOX 3200 Series: Recessed Mount - Model 3275 with recess mounting kit (RMK) with hinged door (Knox eLock Core and trackable with the cloud-based KnoxConnect Management System as required by Fire Department). Unit shall be as manufactured by KNOX Company, 1601 W. Deer Valley Road, Phoenix, AZ 85027. Phone: 1.800.552.5669.

1. Holds up to 10 keys. Access Cards may also be placed inside unit with a corresponding loss of key storage capacity.
2. Gasketed Door for weather resistance - Knox Rainguard.
3. UL Listed: UL 1037, UL 1610 and UL 1332.

4. Options included: Recessed Mounting Kit (RMK). Install unit with mounting hardware provided in accordance with manufacturer's instructions to provide a secure installation.
5. National Fire Code compliant.
6. Unit Size: Recess Mounted Unit Flange: 7 inches wide by 7 inches high by 3 inch recess (3 7/8 inches overall depth)
7. Knox-Coat Color: As selected by the Architect form the manufacturer's full color offering.
8. Location: As indicated by Fire Marshal.

B. Architect Approved Equivalent.

2.04 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, liner and door style indicated.
   1. Weld joints and grind smooth.
   2. Provide factory-drilled mounting holes.
   3. Install door hardware at factory.

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 (13 mm) thick.
   2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.05 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-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.

B. Verify construction of fire rated walls and that Fire Rated extinguisher cabinets are UL labeled as required by wall rating and that the cabinet has been tested to meet ASTM E814.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Install Fire Extinguisher cabinets in strict accordance with the manufacturer's requirements in order to obtain the required fire rating.

3.02 PREPARATION

A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.03 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
   1. Fire-Protection Cabinets: Install as indicated on the drawings to achieve 48 inches above finished floor to top of fire extinguisher handle (ADA) maximum.
   2. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.
   3. Maintain fire ratings where cabinets are recessed into fire-rated wall systems.

B. Identification: Apply vinyl lettering at locations indicated.

C. Wall Signs:
   1. Location: Where shown or directed.
   2. Apply on walls after field painting is completed and has been accepted.

D. Fire Department Key Access Unit: Install Knox Box in accordance with the manufacturer's instructions and in compliance with the Fire Department / Fire Marshal requirements.

3.04 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Ensure that each extinguisher is fully charged, and that inspection of each extinguisher has been performed, as evidenced by the National Association of Fire Equipment Distributors certification tag, just prior to turnover.

F. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: Provide Fire Extinguishers in locations as shown on the drawings and as required by the AHJ.

1.04 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.06 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Failure of hydrostatic test according to NFPA 10.
   b. Faulty operation of valves or release levers.
2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2. UL 299 - Dry Chemical Fire Extinguisher.

2.02 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and wall-mounted bracket as indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
    a. Amerex Corporation.
    b. Ansul Incorporated.
    c. JL Industries, Inc.; a division of the Activar Construction Products Group.
    d. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
    e. Potter Roemer LLC.
    f. Oval Brand Fire Products (Oval Fire Extinguishers)
3. Valves: Nickel-plated, polished-brass body.
4. Handles and Levers: Stainless steel.
5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

1. Model 3010 as manufactured by Potter-Roemer or approved equal.

2.03 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    a. Amerex Corporation.
    b. Ansul Incorporated.
    c. JL Industries, Inc.; a division of the Activar Construction Products Group
    d. Larsen's Manufacturing Company.
    e. Potter Roemer LLC.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    a. Orientation: Vertical.
    b. Signage shall comply with the requirements of the authority having jurisdiction.
    c. Signs shall be provided at each fire extinguisher location and shall be as follows:

1) Enamel-coated Aluminum sign, 24" height by 5" wide, Triangle in shape and multi-angle viewable, Red background with white graphics reading "Fire Extinguisher". Sign shall be suitable for interior and exterior use.
2) Signs shall be UV, chemical, abrasion and moisture resistant.
3) Model No. NHE-7497 Tri as manufactured by Compliance Signs 1-800- 578-1245; Allstate Sign & Plaque 1-800-240-6039 or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install fire extinguishers, fire extinguisher cabinets and mounting brackets and compliance signage in locations indicated and in compliance with requirements of authorities having jurisdiction.
   1. Wall Mounted Fire Extinguishers: Mount Extinguishers as indicated on the drawings.
   2. Cabinet Mounted Fire extinguishers: Mount cabinets as indicated on the drawings. Note: cabinet mounting height shall provide a maximum height of 42" to the top of the extinguisher handle.
B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated. Provide solid blocking in wall behind as required for anchorage of brackets and cabinets.

END OF SECTION

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PART 1 - GENERAL

1.01 SUMMARY

A. This section includes the following:
   1. Sloped monolithic tempered laminated glass panels system and accessories as shown in drawings and as specified.
      a. Provide a complete canopy assembly of monolithic tempered laminated glass panels as part of a complete aluminum framed glazing system with custom-fabricated, engineered structural support system which has been tested and warranted by the manufacturer.
      b. Factory provided anchors, brackets and hardware necessary to complete the assembly and water tightness performance requirements. All flashing up to but not penetrating adjoining work are also required as part of the system and shall be included according to the approved manufacturer submittals.

B. Related Sections: The following sections contain requirements that relate to this section
   1. Division 05 Section “Structural Steel”
   2. Division 07 Section “ Flashing and Sheet Metal”
   3. Division 07 Section “Joint Sealants”

1.02 PERFORMANCE REQUIREMENTS

A. General: Provide a complete system consisting of aluminum frame and monolithic tempered laminated glass panels with custom-fabricated, engineered structural support system. The completed assembly shall be capable of withstanding loads as defined by the local governing codes having jurisdiction where the system is to be installed without failure. Failure to include the following:
   1. Deflection exceeding specified limits.
   2. Thermal stresses transferred to supporting structure.
   3. Framing members transferring stresses, including those caused by thermal and structural movement to glazing.
   4. Weakening of fasteners, attachments and other components.
   5. Deflection Limits: Maximum calculated deflection of any framing member in a direction normal to the glazing plane when subjected to specified design pressures shall be limited to L/360 of its clear span.
   6. Structural Loads: Provide structural monolithic tempered laminated glass panels with custom-fabricated, engineered structural support system assemblies, including anchorage, capable of withstanding the effects of the following design loads:
      a. Roof Loads:
         1) Concentrated Load: <> point load applied to framing members at location that produces the most severe stress or deflection.
         2) Snow Load: See Structural Drawings.
         3) Wind Load: See Structural Drawings.
         4) Seismic Load: See Structural Drawings (appropriate governing load combination when applicable)]
   7. Structural Performance: Uniform Static Air pressure Difference in accordance to ASTM E330/E330M.
      a. 1/4 inch (0.25 inch nominal): No damage or disengagement at (+/-) 180 psf.

b. 3/8 inch (0.375 inch nominal): No damage or disengagement at (+/-) 260 psf.

8. Flammability:
   a. Approved light transmitting plastic with CC1 classification per ASTM D635 and IBC 2606.4.
   b. Smoke density no greater than 75 per ASTM D2843.
   c. Self-ignition temperature, per ASTM D1929 no less than 550 degrees Celsius.
9. Weatherability:
   a. Panels shall consist of monolithic laminated tempered glass panels.
   b. Color change: Per ASTM D2244.
10. Appearance:
   a. Panel thickness: 9/16 inch (0.5625 inch nominal).
   b. Panel profile:
      1) Panel Type: Flat laminated tempered glass with minimal slope for drainage..
      2) Panel width: 24 inches wide (nominal)
      3) Glass Color: As selected by the Architect fromthe manufacturer's full color offering
11. Solar Performance:
   a. Visible light transmission
      1) 9/16 inch tempered laminated Glass: 85%.

1.03 SUBMITTALS

A. Product Data Sheets: Submit manufacturer's product data, including details of construction and installation, materials and finish and installation instructions applicable to the configuration.

B. Shop Drawings:
   1. Provide plans and / or elevations and details of the system and its installation. Flashing sealants and anchorage shall be clearly indicated.
   2. Provide gauges of brake metal, the finish on the framing and any other information required to properly describe and install the system.

C. Delegated Design: Manufacturer shall employ a licensed New York State Professional Engineer to design the complete Canopy system assembly to meet the Performance Requirements and NYSBC loading requirements for all loads imposed on the Canopy Assembly. Engineering calculations, details and Shop drawings indicating compliance to the NYSBC requirements shall be provided. A signed and sealed set of the Delegated Design requirements manual shall be provided to the Architect, Owner and the AHJ.

D. Samples for Selection: Submit manufacturer’s samples for each glazing type (12 inches x 12 inches), framing system (6 inch length), finish, and color specified.

E. Manufacturer’s Certification: Submit manufacturer’s certification that materials comply with specified requirements and are suitable for intended application.

F. Manufacturer’s Project References: Submit list of completed projects including project name and location, name of architect, and type of daylighting manufactured.

G. Warranty: Submit manufacturer's standard warranty.

1.04 REFERENCE STANDARDS:

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2020, with Errata (2022).

B. ASTM A193/A193M - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications; 2020.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

D. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials; 2019.

E. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2020.

F. FBC TAS 201 - Impact Test Procedures; Testing Application Standard; 1994.

G. FBC TAS 202 - Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure; Testing Application Standard; 1994.

H. FBC TAS 203 - Criteria for Testing Products Subject To Cyclic Wind Pressure Loading; Testing Application Standard; 1994.

1.05 WARRANTY

A. Warranty: Written warranty, executed by the manufacturer agreeing to repair components of the specified Cantilevered Canopy system that fail in materials or workmanship within the specified warranty period. Failure includes, but are not limited to the following:
   1. Structural failures.
   2. Failure of systems to meet performance requirements.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

B. System Warranty: Provide written warranty from manufacturer agreeing to replace materials that exhibit defects from manufacturing or fabrication that contribute to water leakage or Structural failure. The manufacturer will, in a timely fashion, furnish new components to replace those found to be defective.
   1. Warranty Period: One (1) year from date of shipment from manufacturer.

C. Finish Warranty: Provide written warranty from manufacturer agreeing to repair or replace work with finish defects. “Defects” is defined as peeling, chipping, chalking, fading, abnormal aging or deterioration and failure to perform as required.
   1. Warranty Period for “Anodized” finish:
      a. Ten (10) Years from date of shipment from manufacturer.
      b. Longer warranty periods available upon request if specified.
   2. Warranty Period for Fluoropolymer PVDF (“Kynar”) finish:
      a. AAMA 2605 (70% Fluoropolymer PVDF) – Ten (10) years from date of shipment from manufacturer.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Basis-of-Design Product: Series 3900 Sleekline monolithic tempered laminated glazing by Duo-Gard Industries Inc. (DGI), 40442 Koppernick Road, Canton, Michigan 48187. Phone (734) 207-9700. Fax (734) 207-7995. Web Site: www.duo-gard.com.

B. Substitutions: See section 012500 - PRODUCT SUBSTITUTION PROCEDURES. Additionally, provide the following:

1. Complete details of proposed glazing system.
2. Complete specifications for Architect’s review.

2.02 MATERIALS

A. Framing System:

1. Shall be extruded aluminum alloy of 6063-T5, 6005-T5 or 6061-T6, ASTM B 221. All sections shall be formed true to detail and free from defects impairing appearance, strength and durability. Provide integral weep holes in factory supplied extrusions and welded corner assemblies to provide end damns where applicable.

B. Glazing Gaskets:

1. Shall be elastomeric, having low friction where in contact with the glazing panel.
2. Shall be compatible with the polycarbonate glazing panel.

C. Special Components:

1. Design and Fabrication to include Cast Connex components and custom fabricated structural steel components as indicated on the drawings. Entire design shall be fabricated in accordance with the approved design provided by the manufacturer's Delegated Design Engineer.

D. Fasteners:

1. In general, concealed fasteners are to be used for all aluminum framing unless noted in submittal drawings.
2. In system construction, the use of adhesives and sealants are not allowed.
3. Where exposed, fasteners shall be stainless steel with stainless steel backed neoprene washers
4. Concealed fasteners shall be stainless steel, ASTM A193/A193M
5. Bolts, anchors and other fastening devices shall be as required for the strength of the connections and shall be suitable for conditions encountered. Washers shall be of the same material as the fasteners.

E. Sealants: Single component, non-sag, high performance, non-priming, gun grade sealant furnished by glazing manufacturer.

1. Factory-Applied Sealant: Gunnable, non-hardening, elastomeric sealant. ASTM C920, Type S, Class 12, Grade NS. Fed Spec TT-S-1657, Type 1.n.
   a. Field-Applied Sealant: Approved by translucent insulated daylighting manufacturer.
   b. Sealant conforms to USDA Approval standards.

F. Flashing:

1. Minimum of 0.060 inch thick Aluminum.

2. Factory formed to project profile(s) in 10-ft. lengths, allow for field trimming and fitment to suit as-built conditions.
3. The finish on this flashing metal shall match as closely as possible the finish on the aluminum framing members.
4. Concealed flashing: Manufacturer’s standard corrosion resistant, non-staining, non-bleeding flashing compatible with adjacent materials
5. Exposed flashing: Aluminum sheet alloy of 5005-H34, 0.060 inch thickness.

G. <> Glazing Panels:

1. Panels shall consist of monolithic laminated tempered glazing panels with a permanent, co-extruded, ultraviolet protective layer on both faces of the panel. This protective layer shall be co-extruded by the manufacturer during the original manufacturing process of the panel and shall be a permanent, non-removable, part of the panel.
2. Provide monolithic (solid) glazing panels as follows:
   a. Thickness: 9/16 inch (0.5625 inch nominal).
   b. Manufactured in The United States.
   c. Color: As selected by the Architect from the manufacturer's full color offering.
   d. Extruded to length:
      1) 1/4 inch (0.25 inch nominal): up to 48 feet in length.
      2) 3/8 inch (0.375 inch nominal): up to 24 feet in length.
      3) 9/16 inch (0.5625 inch nominal): verify with manufacturer.

2.03 FABRICATION

A. Fabricate framing components as follows:

1. Factory prepare, fit and assemble components where practical prior to delivery.
2. Fabricate components that, when assembled, will fit precisely and accurately with mitered or coped ends producing hairline joints free of burrs and distortion.
3. Fabricate components to accommodate thermal expansion and contraction, field adjustment and provide minimum clearance and shimming for proper glazing system installation and performance.
4. Fabricate components to properly drain water passing joints; drain condensation and moisture occurring and mitigating within glazing system to the exterior through internal guttering and a weep system.
5. Fabricate components to ensure that glazing is properly isolated for low friction thermal and physical movement within the glazing system.
6. Fabricate components with straight, sharp profiles and edges free from defects or deformations before finishing.
7. Fabricate, fit and assemble components to the greatest extent practical before finishing.
8. Reinforce components and member as required to retain fastener thread and engagement.
9. Fabricate glazing retainer bars for fastener placement at 12” on center
10. Weld components before finishing and in concealed location to greatest extent practical to minimize distortion and/or discoloration.

B. Provide aluminum framing to the longest lengths possible to minimize splice joints. Splice joints will be sealed and locked with at least a six inch offset between frame components.

C. Provide welded corner assemblies.

D. Prepare aluminum framing components for anchors and connection devices, fasteners and hardware.

E. Fabricate glazing panels as follows:

1. Glazing panels will be shop fabricated to a nominal width of 24”

2.04 ALUMINUM FINISHES

A. General: Comply with NAAMM “Metal Finish Manual” recommendations for application and designations of finishes.

B. Finish designations prefixed by AA conform to the system for designations of aluminum finished established by the Aluminum Association.

1. 70% Fluoropolymer PVDF “Kynar” Finish: complying with AAMA 2605.
   a. Standard Color: As selected by the Architect from the manufacturer's full color offering.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive <> glazing. Notify Contractor / Architect of conditions that would adversely affect installation or subsequent utilization of daylighting. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Ensure supports to receive monolithic glazing are clean, flat, level, plumb, square, accurately aligned, and correctly located.

C. All submitted opening sizes, dimensions and tolerances are to be field verified by the installer unless otherwise stipulated.

D. Installer to examine site conditions to verify readiness. Notify general contractor or owner about any defects requiring corrections, including but not limited to improperly sloping sill substrates and uneven planar substrates. Do not work until conditions are satisfactory

3.02 INSTALLATION

A. Install components in strict accordance with manufacturer’s instructions and approved shop drawings. Use manufacturer recommended fasteners and hardware for material attachments as specified.

B. Use methods of attachment to structure which include provisions for thermal movement.

C. Glazing shall be installed in accordance with panel and system manufacturer’s guidelines.

D. Install glazing panels including flashing, fasteners, hardware, gaskets, joint sealants, and glazing materials required for a complete, weathertight installation.

E. Apply joint sealants in accordance to sealant and system manufacturer’s guidelines. Use sealant approved by system manufacturer.

F. Repair any minor installation marks or damage to metal finish in accordance with manufacturer's instructions and as approved by Architect. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.03 CLEANING

A. During installation, protect exposed surfaces against accumulation of paint, caulking, disfiguration and damage.
B. Interior glazing surfaces shall be cleaned as the panels are being installed. The exterior surfaces shall be cleaned as each phase of the work is completed.
C. Remove excess joint sealant in accordance with sealant manufacturer's instructions.
D. Clean inside and outside of glazing panels immediately after installation and after joint sealants have cured.
E. Follow panel manufacturer’s instructions when cleaning exposed glazing panel surfaces.
F. Clean glazing panels in accordance with panel and system manufacturer’s instructions and guidelines.
G. Do not use harsh cleaning materials or methods that would damage metal finish or glazing.

3.04 PROTECTION

A. Protect installed glazing and Canopy structure from damage during construction.
B. Remove and replace damaged glazing and Canopy components as determined by Architect.

END OF SECTION

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1.01 SECTION INCLUDES

A. REFERENCE STANDARDS

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. Rooftop equipment screens for enclosing roof top mechanical equipment.

1. ABS
2. Aluminum

E. Aluminum Support Framing: For direct attachment of screening panels to mechanical equipment; no base or curb required unless shown otherwise on drawings.

F. Sliding Panels: For access to mechanical equipment for servicing.

G. Not Included in This Specification:

1. Touch-up painting required for scratches and screw heads.
2. Field painting of prime painted screens.

1.02 RELATED SECTIONS

A. Section 01 23 00 - Alternates. For direction regarding bidding of screens as alternates.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM): ASTM B221 - Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire Profiles, and Tubes.

B. The Aluminum Association, Inc. (AA): AA ADM-1516166 - Aluminum Design Manual

C. American Society of Civil Engineers (ASCE): ASCE 7-18 - Minimum Design Loads for Buildings and Other Structures

1.04 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data:

1. Manufacturer's data sheets on each product to be used.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Typical installation methods.
5. Sufficient data and detail to indicate compliance with these specifications.

C. Verification Samples: Two representative units of each panel type.

1. Color Selection: Submit paint chart with full range of colors available for Architect's selection. Custom color samples available upon purchase.

D. Shop Drawings: Indicate layout heights, component connection details, and details of interface with adjacent construction.

1. Roof top mechanical equipment to be enclosed.

E. Certification: Manufacturer's Certificate of Compliance certifying that panels supplied meet or exceed requirements specified.
   1. Professional Engineer stamped drawings.
F. Closeout Submittals: Warranty documents, issued and executed by manufacturer, countersigned by Contractor.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum of one year documented experience.
B. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.
C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.
D. Mock-Up: Construct a mock-up with actual materials in sufficient time for Architect’s review and to not delay construction progress. Locate mock-up as acceptable to Architect and provide temporary foundations and support.
   1. Intent of mock-up is to demonstrate quality of workmanship and visual appearance.
   2. If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
   3. Retain mock-up during construction as a standard for comparison with completed work.
   4. Do not alter or remove mock-up until work is completed or removal is authorized.

1.06 PRE-INSTALLATION CONFERENCE

A. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items, and approvals.
   1. Notify Architect four (4) calendar days in advance of scheduled meeting date.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
B. Storage and Handling: Protect materials and finishes during handling and installation to prevent damage.
C. Protect from damage due to weather, excessive temperature, and construction operations.

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

B. Field Measurements: Take measurements of supporting paving, footings, or piers. Indicate measurements on shop drawings fully documenting any field condition that may interfere with the screen system installation.

1.09 COORDINATION

A. Installer for work under this Section shall be responsible for coordination of panel and framing sizes and required options with the Contractor's requirements.
   1. Request information on sizes and options required from the Contractor.
B. Submit shop drawings to the Contractor and obtain written approval of shop drawing from the Contractor prior to fabrication.

1.10 WARRANTY

A. Warranty: Provide manufacturer’s standard limited 3 year warranty, starting from the date of substantial completion of the project.
B. This warranty does not cover failure of your rooftop equipment screen if the Owner damages it, or if the failure is caused by improper installation. In no event shall the Warrantor be liable for incidental or consequential damages.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: CityScapes International Inc., which is located at: 4200 Lyman Ct., Hilliard, OH 43026; Toll Free: 877-SCREENS; Phone: 614-850-2549; Email: Contact@cityscapesinc.com; Web: https://cityscapesinc.com/ or approved equal
B. Requests for substitutions will be considered in accordance with the provisions of Section 016000.

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

A. Regulatory Requirements: Comply with requirements of building authorities having jurisdiction in Project location.
B. Design Criteria:
   1. Rooftop Equipment Screens:
      a. The manufacturer is responsible for the structural design of all materials, assembly, and attachments to resist snow, wind, suction, and uplift loading at any point without damage or permanent set.
      b. Framing shall be designed in accordance with the Aluminum Design Manual to resist the following loading:
         1) ASCE 7-18 - Minimum Design Loads for Buildings and Other Structures; American Society of Civil Engineers.
      c. Default Clear Space Between Equipment and Screen: 36 inch (914.4 mm) nominal.
      d. Standard Truss Sizes: 36 and 48 inch (914 and 1219 mm).
      e. Screen Heights: 35, 52, and 70 inches (1778 mm) and may be stacked as needed.
      f. Corners may have one panel mounted at 45 degrees.
      g. Screens may partially surround units.

h. Trusses: Should be spaced no further than 96 inches (2438.4 mm) along cabinet perimeter.

2. Design Requirements to be Supplied to Manufacturer:
   a. Obstructions above unit base rail elevation and within 72 inches (1828.8 mm) of unit must be identified.
   b. Access panels, access doors, vent hoods, power disconnects, etc. must be accounted for in design; clearly noted on unit cut sheets or roof plans provided to Manufacturer.
   c. Equipment Obstruction Details Provided to Cityscapes: Such as door swings, horizontal ducting, or piping may be made to run between top and bottom rails. Contact Manufacturer for custom solutions.
   d. Post Mounting Systems: By others. Must have all steel sizing provided.
3. Limitations:
   a. Screens may be designed 22 to 60 inches (559 to 1524 mm) clear, as decided necessary by Manufacturer.
      1) Requests for special clearances should be noted.
   b. Screen Heights:
      1) Cannot exceed 8 inches (203.2 mm) more than cabinet height.
      2) Units may have varying screen heights if needed to clear obstructions such as parapet walls.
   c. Top Trim: May be added to cover as much of the unit above attachment points.
   d. Screen Supports: To be attached below any drip edges.
   e. Spans Between Supports Larger than 100 inches (2540 mm): May require a post mount support.
      1) Steel HSS by others.
      2) Free-standing support posts provided by Manufacturer.
   f. Unit-Attached Envisor Screens in Florida:
      1) Must be fully enclosed 4-sided.
      2) Post mounted systems in Florida do not need to be fully connected 4-sided.
      3) Systems located in Florida may use either a Vertical Rib ABS panel style or a metal panel style.
   g. Removable Screen Sections:
      1) May be used for large maintenance clearances under special conditions:
      2) Removable Sections:
         (a) Fit between two trusses.
         (b) Are not adjacent to one another; two trusses either side of section.
         (c) Are not placed on the ends of partially sided systems.
   h. Units May be Nested Together If:
      1) Cabinets are suitable for screen attachment.
      2) Cabinets are no further than 96 inches (2438.4 mm) apart.
      3) Units have similar cabinet and curb heights.
      4) Units are not on isolation/vibration curbs.
   i. If nested look is desired but not possible for one of the reasons above, independent screens can be sized to fit together with small gaps.

2.03 MATERIALS

A. Thermoformed Plastic Panels: Fabricated from rigid medium impact thermo-formed ABS (Acrylic Butylene Styrene) sheets.

1. Minimum thickness: 3/16 inch (4.76 mm).

B. Powder Coated or Painted Metal Panels: Fabricated from rigid aluminum panels in multiple thicknesses.
   1. Minimum Thickness: 0.050 inches (1.27 mm).
C. Perforated Metal Panels: Fabricated from rigid aluminum panels in multiple thicknesses.
   1. Minimum Thickness: 0.063 inches (1.6 mm).
D. Framing: Aluminum Plate, Shapes and Bar: ASTM B221, alloy 6061-T5 or 6063-T5.
E. Threaded Fasteners: Screws, bolts, nut, and washers to be Stainless steel.
   1. Corner Assembly Fasteners: No. 12-14 x 1-1/4 inches (32 mm) stainless steel self-drilling screws.
      a. Length: As required to develop full holding capacity of screw when fastened to Mechanical Equipment.
   2. Provide lock washer or other locking device at all bolted connections.

2.04 FABRICATION

A. Provide factory-formed panel systems with continuous interlocking panel connections and indicated or necessary components: Form all components true to shape, accurate in size, square and free from distortion or defects. Cut panels to precise lengths indicated on approved shop drawings.
B. Fabricate all panels to slide horizontally to allow access to unit access panels behind.
C. Design, and Trim:
   1. Panel Design: AcryliCap. 7.2 Rib.
   2. Panel Design: AcryliCap. Horizontal Rib.
   3. Panel Design: AcryliCap. Vertical Rib.
   4. Panel Design: AcryliCap. Louver.
   5. Panel Design: AcryliCap. Pan.
   6. Panel Design: AcryliCap. Brick.
   7. Panel Design: AcryliCap. Custom.
   8. Panel Design: Metal Series. 7.2 Rib Horizontal.
   9. Panel Design: Metal Series. 7.2 Rib Horizontal Perforated.
   10. Panel Design: Metal Series. 7.2 Rib Vertical.
   11. Panel Design: Metal Series. 7.2 Rib Vertical Perforated.
   12. Panel Design: Metal Series. 4.0 Rib Horizontal.
   13. Panel Design: Metal Series. 4.0 Rib Vertical.
   14. Panel Design: Metal Series. Pan.
   15. Panel Design: Metal Series. Vented Louver.
   16. Panel Design: Metal Series. Pan Perforated.
   17. Panel Design: Metal Series. Custom.
   18. Decorative Top Trim Profile: Band.
   19. Decorative Top Trim Profile: Step 2.
   20. Decorative Top Trim Profile: Step 3.
   21. Decorative Top Trim Profile: Cove.
   22. Decorative Top Trim Profile: Alamo.
D. Trim and Closures: Material: Aluminum. Thickness: 0.050 to 0.25 inches (1.27 to 6.35 mm),
   1. Finish: Manufacturers standard coating system, unless shown otherwise on drawings.

E. Framing: Fabricate and assemble components in largest practical sizes, for delivery to Project site.
   1. Corner Assemblies: Construct to required shape with joints tightly fitted.
   2. Components Required Framing Anchorage: Fabricate anchors and related components of material and finish as required, or as specifically noted.

2.05 FINISHES

A. Aluminum Framing: Mill finish.

B. Panel Coating: Manufacturer's standard powder coating system, factory applied.
   1. Color: Selected from full range of manufacturer's standard colors.
   2. Color: Custom color paint or powder coat as selected and approved by Architect. Finish type is determined by project size.

PART 3 EXECUTION

3.01 EXAMINATION

A. Installer's Examination: Examine conditions under which construction activities of this section are to be performed.
   1. Submit written notification to Architect and Screen manufacturer if such conditions are unacceptable.
   2. Beginning erection constitutes installer's acceptance of conditions.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install screen systems in accordance with the manufacturer's instructions and approved shop drawings. Keep perimeter lines straight, plumb, and level. Provide brackets, anchors, and accessories necessary for a complete installation.

B. Fasten structural supports to HVAC units without damaging the operation of the unit.
   1. Provide corner and mid-span assemblies as required by approved shop drawings so that the panels are supported uniformly.
   2. Fastening bottom rail using bolts to permit ease of access to HVAC units.

C. Insert panels into structural supports, except where fixed attachment points are indicated. Butt panels to adjacent panels for uniform fit. Fasten fixed panels in accordance with the shop drawings.

D. Metal Separation: Where aluminum materials would contact dissimilar materials, insert rubber grommets at attachment points, thus eliminating where dissimilar metals would otherwise be in contact.

E. Do not cut or abrade finishes which cannot be restored unless instructed. Return items with such finishes to shop for required alterations.

3.04 ERECTION TOLERANCES

A. Maximum misalignment from true position: 1/4 inch (6.35 mm).

3.05 CLEANING AND PROTECTION

A. Remove all protective masking from material immediately after installation.

B. Protection:

1. Ensure that the finishes and structure of installed systems are not damaged by subsequent construction activities.
2. If minor damage to finishes occurs, repair damage in accordance with manufacturer's recommendations; provide replacement components if repaired finishes are unacceptable to Architect.

C. Prior to Substantial Completion: Remove dust or other foreign matter from component surfaces; clean finishes in accordance with manufacturer's instructions.

1. Clean units in accordance with the manufacturer's instructions.

END OF SECTION

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PART 1 - GENERAL

0.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

0.02 SUMMARY

A. Section includes passenger elevators including but not limited to:
   1. Pre-engineered MRL Traction passenger elevator.
   2. Elevator Car enclosure, hoistway entrances and signal equipment.
   3. MRL Equipment
   4. Operation and control systems.
   5. Accessibility provisions for physically handicapped persons.
   6. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated capacity and speed.
   7. Materials and accessories as required to complete the elevator installation.
   8. Inserts mounted in block walls for rail attachments.
   9. Furnish elevator hoistbeam and safety tube. Installation by General Contractor.
   10. Furnish and install pit ladder.

0.03 RELATED SECTIONS:

A. Section 015000 - Temporary Facilities and Controls: protection of openings and personnel barriers, temporary power and lighting including but not limited to:
   1. Removable barricades at all hoistway openings, in compliance with OSHA 29 CFR 1926.502 in addition to any local code requirements.
   2. Lifeline attachments capable of withstanding 5000 lb load in accordance with OSHA 29 CFR 1926.502. Provide a minimum of 2 at the top, front of each hoistway

B. Section 033000 - CAST-IN PLACE CONCRETE for setting sleeves, inserts, and anchoring devices in concrete.

C. Section 042200 - ORNAMENTAL METAL GRILLES for setting sleeves, inserts, and anchoring devices and coordinating wall openings for oil line and wiring ducts in masonry and for grouting elevator entrance frames installed in masonry walls.

D. Section 051200 - Structural Steel Framing for the following:
   1. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
   2. Divider beams.
   3. Hoist beams.
   4. Structural-steel shapes for subsills that are part of steel frame.

E. Section 05055000 - METAL FABRICATIONS for the following:
   1. Attachment plates and angle brackets for supporting guide-rail brackets.
   2. Divider beams.
   3. Hoist beams furnished by Elevator Company, installed by General Contractor.
   4. Structural-steel shapes for subsills.
   5. Pit ladders.

6. Cants in hoistways made from steel sheet.

F. Division 07: Waterproofing: waterproofing of elevator pits.

G. Division 08: Openings: Access Doors: As required for access to governor and/or seismic switch. Access door shall be self-closing, self-locking if necessary and operable from the inside without a key.

H. Division 09 for finish flooring in elevator cars.

I. Section 099123 - INTERIOR PAINTING for field painting of hoistway entrance doors and frames.

J. Section 221429 - SUMP PUMP for sump pumps, oil interceptors, sumps, and sump covers in elevator pits.

K. Division 23: Heating, Ventilating and Air Conditioning:

1. Heating and Ventilating of hoistways and Machine Rooms.

L. Division 26 for:

1. Smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.
2. Providing electrical service to elevator, including fused disconnect switches.
3. Emergency power supply, transfer switch and auxiliary contacts.
4. Convenience outlets and illumination in Machine Room, hoistway and pit.
5. Pit lighting: Fixture with switch and guards. Provide illumination level equal to or greater than that required by ASME A17.1, or applicable version.
6. Control space lighting with switch. Coordinate switch with lighting for machine space as allowable by code
7. Light outlet in the center of hoistway as indicated by the elevator contractor.
8. Standby Power Supply Systems: emergency generator for elevator operations.
9. Telephone Systems: ADAAG required emergency communications systems.
10. Provision of telephone and convenience outlet on control panel.

0.04 REGULATORY REQUIREMENTS

A. 29 CFR 1926.502 - Fall protection systems criteria and practices; Current Edition.

B. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2019, with Errata (2021).

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

D. ISO 9001 - Quality Management Systems — Requirements; 2015.

E. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

H. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

I. ADA Standards, Buildings and Facilities, Providing Accessibility and Usability for Physically Handicapped People.

0.05 SYSTEM DESCRIPTION

A. Application: Machine Room Less (MRL) gearless traction elevator

B. Machine Location: Inside the hoistway mounted on car <> guide rails.

C. Control Space Location: Integrated control.

D. Elevator Types and Performance Requirements:

1.	Quantity of Elevators:	One (1)
2.	Elevator Model:	Monospace 500 DX
	Controller / Drive Type	KCM831
3.	Operation System:	Simplex
	Drive:	Non-Regenerative
4.	Elevator Number(s):	Elevator No. No. 1
5.	Service:	General Service
6.	Number of stops /opgs.	
	Elevator No. 1	Three (3) stops, All front.
7.	Travel:	
	Elevator No. 1	22'-4"
8.	Rated Capacity:	
	All Elevators	3500 lb. capacity
9.	Speed:	
	All Elevators	150 fpm
10.	Cab Size:	
	Elevator No. 1	6'-5 11/16" wide by 5'-6 11/16" deep
11.	Cab Heights:	All 8'-0" height nominal or as indicated.
	Ceiling Clear height.	7'-6"
12.	Hoistway Entrance Size:	All 3'-6" wide x 7'-0" high
13.	Door Type:	Two Speed Side-Slide
14.	Power Characteristics:	208 volts, 3 Phase, 60 Hz.
15.	Seismic:	No
16.	Fixture and Button Style:	Stainless Steel 301 Push Buttons.
17.	Special Operations:	Fire Service Phase 1 and Fire Service Phase 2

E. Car Performance

1. Car Speed ± 5% of contract speed under any loading condition or direction of travel.
2. Car Capacity: Safely lower, stop and hold (per code) up to 125% of rated load.

F. Ride Quality:

1. Vertical Vibration (maximum): 15 mg
2. Horizontal Vibration (maximum): 12 mg
3. Vertical Jerk (maximum): 3 ft/sec^3 (1m/s^3)
4. Acceleration (maximum): 1.3 ft/sec^2 (0.4 m/s^2)
5. In Car Noise: 55 dB(A) Maximum
6. Stopping Accuracy: ±0.2 inches (5 mm)
7. Starts per hour (maximum): 240

G. Elevator Operation:

1. a. Simplex Collective Operation: Using a microprocessor based controller, operation shall be automatic by means of the car and hall buttons. When all calls have been answered, the car shall park at the last landing served.

H. Operating Features - Standard:

1. Door Light Curtain Protection
2. Static AC Drive
3. Phase Monitor Relay
4. Cab Overload with Indicator
5. Load-weighing
6. Central Alarm
7. Remote Monitoring
8. Firefighter’s Operation
9. Automatic Evacuation
    a. When the main line power is lost for longer than 5 seconds the emergency battery power supply provides power automatically to the elevator controller. If the car is at a floor when the power fails, it remains at that floor, opens its doors, and shuts down. If the car is between floors, it is raised or lowered to the first available landing, opens it doors, and shuts down.
10. Independent Service

0.06 ACTION SUBMITTALS

A. Comply with Section 013300 - SUBMITTALS.

B. Product Data: Submit manufacturer's product literature for each proposed system.

1. Cab design, dimensions, capacities, and layout.
2. Layout, wall and ceiling finishes, and accessories and available options.
3. Controls, fixtures and button types, operation systems, signals, safety features and operating system.
4. Color and metal finish selection charts for cab wall and ceiling finishes and entrances.

C. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing, pit and hoistway, erection and anchorage, details of assembly and coordination with building structure, relationships with other construction, and locations of equipment.
2. Include equipment arrangements in the control space, pit and hoistway.
3. Include large-scale layout of car-control station.
4. Indicate floors served, travel distances, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
5. Hoist beam requirements.
6. Location and sizes of access doors.
7. Indicate electrical power requirements including: Horsepower, starting current, running current, machine and control heat release and branch circuit protection devices recommended.

D. Samples for Initial Selection: For finishes involving color selection such as powder coating, plastic laminates, metals and other exposed finishes requiring selection.

E. Operation and Maintenance Manual: Submit manufacturer/installer's operation and maintenance manual; including operation, maintenance, adjustment, and cleaning instructions; trouble shooting guide; renewal parts catalogs; and electrical wiring diagrams.

F. Diagnostic Tools

1. Prior to seeking final acceptance for the completed project as specified by the Contract Documents, the Elevator Contractor shall deliver to the Owner any specialized tool(s) that may be required to perform diagnostic evaluations, adjustments, and/or parametric software changes and/or test and inspections on any piece of control or monitoring equipment installed.
    a. Include any specialized tool(s) required for monitoring, inspection and/or maintenance where the means of suspension other than conventional wire ropes are furnished and installed by the Elevator Contractor. Any and all such tool(s) shall become property of the Owner. Any diagnostic tool provided to the Owner by the Elevator Contractor shall be configured to perform all levels of diagnostics, systems adjustment and parametric software changes which are available to the Elevator Contractor.
    b. In those cases where diagnostic tools provided to the Owner require periodic recalibration/or re-initiation, the Elevator Contractor shall perform such tasks at no additional cost to the Owner for a period equal to the term of the maintenance agreement from the date of final acceptance of the competed project During those intervals in which the Owner might find it necessary to surrender a diagnostic tool for re-calibration, re-initiation, or repair, the Elevator Contractor shall provide a temporary replacement for the tool at no additional cost to the Owner.
    c. The Elevator Contractor shall deliver to the Owner, printed instructions for the proper use of any tool that may be necessary to perform diagnostic evaluations, system adjustment, and/or parametric software changes on any unit of microprocessor-based elevator control equipment and means of suspension other than standard elevator steel cables furnished and install by the Elevator Contractor.
    d. Accompanying the printed instructions shall be any and all access codes, password, or other proprietary information that is necessary to interface with the microprocessor-control equipment

G. Warranty: Submit manufacturer/installer's standard warranty.

1. Provide manufacturer warranty for a period of one year. The warranty period is to begin upon final acceptance of the Project. Warranty shall cover defects in materials and workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

0.07 INFORMATIONAL SUBMITTALS

A. Installer Qualifications: The equipment manufacturer shall install the elevator.

B. Qualification Data: For Installer.

C. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service including standby power generator, as shown and specified, are adequate for elevator system being provided.

D. Sample Warranty: For special warranty.

0.08 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals, wiring diagrams and Parts list with recommended parts inventory.
   1. In addition to items specified in Section 017823 - OPERATING AND MAINTENANCE DATA include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

0.09 QUALITY ASSURANCE

A. Manufacturer Qualifications: An approved manufacturer with minimum fifteen (15) years experience in manufacturing, installing, and servicing elevators of the type required for the project.
   1. Must be the manufacturer of the power unit, controller, signal fixtures, door operators cab, entrances, and all other major parts of the elevator operating equipment.
      a. The major parts of the elevator equipment shall be manufactured in the United States, and not be an assembled system.
      b. All safety components must be certified by a qualified 3rd party certification body (ie. Safety, governor, brakes, rope grippers, ascending car protection, and door locks).
   2. The manufacturer shall have a documented, on-going quality assurance program.
   3. ISO 9001:2000 Manufacturer Certified
   4. ISO-14001:2004 Environmental Management System Certified.

B. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer. Installer shall have a least fifteen (15) years of satisfactory experience installing elevators equal in scope, character and performance to the project elevators.

C. Fire-rated Entrance Assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, UL 10B, and NFPA 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory.

D. Inspection and testing: Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
   1. Arrange for inspections and make required tests.
   2. Deliver to the Owner upon completion and acceptance of elevator work.

0.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

B. Manufacturer will deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site in accordance with manufacturer/installer’s instructions.

C. Handling: Protect materials during handling and installation to prevent damage.

0.11 PROJECT CONDITIONS

A. Prohibited Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

B. General Construction Contractor shall coordinate the provisions for temporary electric and GFCI-protected electricity to be available for the installation of elevator components.

C. General Construction Contractor shall provide a temporary work platform at the top floor of the hoistway compliant with applicable codes and in accordance with the layout drawing specification provided by the approved elevator manufacturer.

0.12 COORDINATION

A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

B. Coordinate locations and dimensions of other work relating to the elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, and pits.

C. Prohibited Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

0.13 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Warranty Period: One (1) year from date of Substantial Completion.

0.14 MAINTENANCE

A. Furnish maintenance and 24-hour, 7 days a week call back service for a period of 12 months for each elevator from date of Substantial Completion during normal working hours, excluding callbacks. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation. Predictive maintenance shall be included for the full maintenance period. This service must be capable of

using AI-based analytics to identify potential equipment issues and notifying the elevator provider via an internet connection.

1. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.
2. Elevator maintenance service shall be performed by elevator manufacturer/installer.
3. Replacement parts shall be produced by the original equipment manufacturer.

B. Elevator Control System:

1. Include built-in remote diagnostic module to relay constant status of elevators and control system to a 24-hour, 7-days-a-week central-monitoring facility.
2. Remote Monitoring Device: Transmit information on current status of elevators, including malfunctions, system errors, and shutdown.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: Subject to compliance with requirements, provide products by Kone Elevator 4225 Naperville Road, Lisle, IL 60532. Phone (630) 577-1650. Website www.kone.us.

1. Architect approved equivalent.

B. Source Limitations: Obtain elevators from single manufacturer.

1. Major elevator components, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

C. Elevator shall be installed by elevator manufacturer or an manufacturers approved / licensed installer.

2.02 MATERIALS, GENERAL

A. All Elevator Cab materials including frame, buttons, lighting, wall and ceiling assembly, laminates and carpet shall have an EPD and an HPD and shall be as selected by the Interior Designer.

B. Colors, patterns, and finishes: As selected by the Architect or Interior Designer from manufacturer's standard colors, patterns, and finish charts.

C. Steel:

1. Shapes and bars: Carbon.
2. Sheet: Cold-rolled steel sheet, commercial quality, Class 1, matte finish.
3. Finish: Factory-applied baked enamel.

D. Plastic laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.050" thickness. Laminate selection shall be based on elevator manufacture’s standard selections.

E. Floor Finish: by General Contractor. See Division 09 and indicated finish on the drawings.

2.03 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1.

B. Accessibility Requirements: Comply with Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

2.04 EQUIPMENT: CONTROL COMPONENTS AND CONTROL SPACE

A. Controller: Provide microprocessor based control system to perform all of the functions of safe elevator operation, as well as perform car and group operational control.
   1. All high voltage (110v or above) contact points inside the inspection and test panel shall be protected from accidental contact in a situation where the access panels are open.
   2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.
   3. Provide a serial cardrack and main CPU board containing a non- erasable EPROM and operating system firmware.
   4. Variable field parameters and adjustments shall be contained in a non- volatile memory module.

B. Drive: Provide a Variable Voltage Variable Frequency AC Closed Loop drive system. Provide stable start without high peak current, quickly reaching a low energy consumption level.

C. Controller Location: Locate controller<> in the front wall integrated with the top landing entrance frame, machine side of the elevator. One non-fused three phase permanent power in hoist way at top landing. A separate control space should not be required.

D. Inspection and Test Panel: Integrated control equipment, main inspection and test panel in door frame at top level served or at one floor below the top level served.

2.05 EQUIPMENT: HOISTWAY COMPONENTS

A. Machine:
   1. Gearless asynchronous AC motor with integral drive sheave, service and emergency brakes.
   2. Design machine to enable direct power transfer, thereby avoiding loss of power.
   3. Design machine to be compact, lightweight and durable to optimize material usage and save space.
   4. Mount to structural support channels on top of guide rail system as applicable in hoistway overhead.

B. Governor:
   1. Tension type over-speed governor with remote manual reset.
   2. Mount to structural support channels as applicable in hoistway overhead.

C. Buffers, Car and Counterweight: Compression spring type buffers to meet code.

D. Hoistway Operating Devices:
   1. Emergency Stop switch in the pit.
   2. Terminal stopping switches.
   3. Emergency stop switch on the machine.

E. Positioning System: System consisting of proximity sensors and door zone vanes.

F. Guide Rails and Attachments: Provide Tee-section steel rails with brackets and fasteners. Side counterweight arrangements shall have a dual purpose bracket that combines both counterweight guide rails, and one of the car guide rails to building fastening.

G. Suspension System: Industry standard steel wire rope.

H. Governor rope: Steel wire rope with 6 mm diameter.

2.06 EQUIPMENT: HOISTWAY ENTRANCES

A. Hoistway Doors and Frames:
   1. UL rated with required fire rating.
   2. Doors: 16 Gauge, Rigid flush panel construction with reinforcement ribs.
   3. Frames: Securely fastened at corners to form unit frame. Frames shall be Knock-down style bolted.
   4. Star of Life: Provided as required.

B. Finish:
   1. Exposed Areas of Corridor Frames: #4 Brushed Stainless Steel - All Floors
   2. Doors: #4 Brushed Stainless Steel - All Floors
   3. Sills: Extruded Aluminum - All Floors

C. Entrance Markings and Jamb Plates: Provide standard entrance jamb tactile markings on both jambs, at all floors. Plate Mounting: Refer to manufacturer drawings.

2.07 EQUIPMENT: CAR COMPONENTS

A. Car Frame and Safety: Provide car frame with adequate bracing to support the platform and car enclosure. Car Safeties: Device will be provided and mounted under the car platform, securely bolted to the Car Frame. The safety will be actuated by a centrifugal governor mounted at the top of the hoistway. The Safety is designed to operate in case the car attains excessive descending speed.

B. Platform: Provide platform of steel construction with plywood subfloor and aluminum threshold.

C. Car Guides: Provide sliding guide shoes mounted to top and bottom of both car and counterweight frame. Arrange each guide shoe assembly to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.

D. Provide central guiding system to reduce mechanical friction and energy consumption.

E. Steel Cab:
   1. Fire rating: Provide Class B fire rating for cab, or Class A fire rating where required by local Code.
   2. Car wall finishes: Wheat Strand Laminate (L430) for side walls for Elevator<> No. 1. and Wheat Strand Laminate (L430) for Rear Wall for Elevator<> No. 1.
   3. Base and frieze: #4 Brushed Stainless Steel.
   4. Car front finish: #4 Brushed Stainless Steel.
   5. Car door finish: #4 Brushed Stainless Steel.
   6. Ceiling: Canopy ceiling, Down light type, Stainless Steel metal pans with suspended LED down lights (CL88).

7. Handrails: Provide 1 1/2 inch Round on side and rear walls on front opening cars and side walls only on front and rear opening cars. Handrails shall have a #4 Brushed Stainless Steel finish. Handrail Ends shall be Straight.
8. Flooring: See Finish Schedule. Note: Not to exceed ½" finished depth and 6 lbs/sqft.
9. Car Sill Material: Extruded Aluminum.
10. Protection Pads: Included.
11. Ventilation: Manufacturer's standard cab fan.
12. Emergency Car Signals:
    a. Emergency Car Lighting: Provide an emergency power unit employing a 12-volt sealed rechargeable battery and static circuits to illuminate the elevator car and provide current to the alarm bell in the event of building power failure.
    b. Emergency Siren: Provide siren mounted on top of the car that is activated when the Alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.
    c. Emergency Exit Switch: Provide an electrical contact to open the safety circuit when the emergency car top exit is opened. When the exit door is opened, the top exit switch shall signal the control and the car will be unable to move.
    d. Emergency Exit Lock: Provide an emergency exit lock where required by local code.

2.08 DOOR OPERATOR AND CONTROL

A. Door Operator: Provide a closed loop VVVF high performance door operator with frequency controlled drive for fast and reliable operation to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

B. In case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Provide emergency devices and keys for opening doors from the landing as required by local code.

C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. Provide door open button in the car operating panel. Momentary pressing of this button shall reopen the doors and reset the time interval.

D. Provide door hangers and tracks for each car and hoistway door. Contour tracks to match the hanger sheaves. Design hangers for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed for life bearings.

E. Electronic Door Safety Device: Equip car doors with concealed transmitter and receiver infrared beam devices to detect presence of object in process of passing through hoistway entrance and car doorway (light curtain device).
    1. Use multi-beam scanning without moving parts to detect obstructions in door opening.

2. Detector Device: Prevent doors from closing, or if they have already started closing, cause doors to reopen and remain open while object is within detection zone.
3. Horizontal Beams: Minimum of 33 infra red beams to fill doorway from ground level to a height of 6 feet.

2.09 EQUIPMENT SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: Provide a car operating panel with all push buttons, key switches and message indicators for elevator operation. Fixture finish to be Brushed Stainless Steel.

1. Main Flush mounted car operating panel shall contain a bank of round, mechanical, illuminated buttons marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. Buttons have Amber Dot Matrix illumination (halo). All buttons to have raised text and Braille marking on left hand side. The car operating display panel shall be Amber Dot Matrix. All texts, when illuminated, shall be Amber Dot Matrix. The car operating panel shall have a Brushed Stainless Steel finish.
2. Comply with handicap requirements.
3. Emergency Buttons: Provide in accordance with code. Emergency alarm button, door open and door close buttons.

B. Features of the Car Operating Panel Shall Include:

1. Audible chime to signal that the car is either stopping at or passing a floor served by the elevator.
2. Raised markings and Braille provided to the left hand side of each push button.
3. Car Lantern: Provide LED illuminated car lantern with direction arrows to comply with local code when hall lanterns are not provided.
4. Door open and close push buttons.
5. Call Cancel Button.
6. In car stop switch per local code.
7. Car Position Indicator within operating panel - Brushed Stainless Steel
8. Firefighter’s hat and Phase 2 Key-switch
9. Inspection key-switch.
10. Key-switch for optional Independent Service Operation
11. Illuminated alarm button with raised marking.
12. Elevator Data Plate marked with elevator capacity and car number.
13. Help Button: Activation of help button will initiate two-way communication between car and a location inside the building, switching over to alternate location if call is unanswered, where personnel are available to take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.

C. Hall Fixtures: Provide hall fixtures with necessary push buttons and key switches for elevator operation. Hall fixtures shall have a Brushed Stainless Steel finish. Signalization Series: KSS570.

1. Push buttons: Metallic tactile push buttons, up button and down button at intermediate floors, single button at each terminal floor.
2. Height: Comply with handicap requirements.
3. Illumination: Illuminating using long-lasting low power LEDs.

D. Hall Lanterns and Position Indicators.

1. LED illuminated direction arrows with audible and visible call acknowledgement.

E. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel, and a chime will sound. The chime will sound once for up and twice for down. The car riding lantern face plate shall have a Brushed Stainless Steel finish

F. Hoistway access switches: Provide key-switch at top and/or bottom floor in entrance jamb as required by local code.

G. Firefighter's Phase 1 Service: Key switch in brushed stainless steel cover plate.

H. Fixture Cover Plates: For push buttons, hall lanterns and position indicators, resistant white back-printed glass, no screws required for mounting. Provide stainless steel cover plates for Firefighter's Phase I switch and hoistway access switches, with tamper resistant screws in same finish.

I. Mounting: Mount hall fixtures in entrance frames.

2.10 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and machine rooms/control space, as constructed and verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Verify hoistway is clear and plumb, with variations not to exceed -0 to +1 inch at any point. Verify projections greater than 4" must be beveled not less than 75 degrees from horizontal. No negative tolerance is permitted for minimum hoistway dimensions.

C. Field measure and examine substrates, supports, and other conditions under which elevator work is to be performed.

D. Prior to start of work, verify hoistway is in accordance with shop drawings. Dimensional tolerance of hoistway from shop drawings: -0 inches +2 inches. Do not begin work of this section until dimensions are within tolerances.

E. Prior to start of work, verify projections greater than two inches (four inches if ASME A17.1 applies) must be beveled not less than 75 degrees from horizontal.

F. Prior to start of work, verify landings have been prepared for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.

G. Prior to start of work, verify elevator pit has been constructed in accordance with requirements, is dry and reinforced to sustain vertical forces, as indicated in approved submittal. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.

H. Prior to start of work, verify control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including sleeves and penetrations.

I. Verify installation of GFCI protected 20-amp in pit and adjacent to each signal control cabinet in control space.

J. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work. Proceed with installation only after unsatisfactory conditions have been corrected.

K. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSTALLATION

A. Install elevator systems components and coordinate installation of hoistway wall construction.
   1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
   2. Comply with the National Electrical Code for electrical work required during installation.

B. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.

C. Coordinate installation of anchors, bearing plates, brackets and other related accessories.

D. Interface with Other Work:
   1. Guide rail brackets attached to steel shall be installed prior to application of fireproofing.
   2. Coordinate construction of entrance walls with installation of door frames and sills. Maintain front wall opening until elevator equipment has been installed.
   3. Ensure adequate support for entrance attachment points at all landings.
   4. Coordinate wall openings for hall push buttons, signal fixtures and sleeves. Each elevator requires sleeves within the hoistway wall.
   5. Coordinate emergency power transfer switch and power change pending signals as required for termination at the primary elevator signal control cabinet in each group.
   6. Coordinate interface of elevators and fire alarm system.
   7. Coordinate interface of dedicated telephone line.

E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing. Verify hoistway is clear and plumb, with variations not to exceed -0 to +1 inch at

any point. Verify projections greater than 4” must be beveled not less than 75 degrees from horizontal. No negative tolerance is permitted for minimum hoistway dimensions.

F. Lubricate operating parts of systems as recommended by manufacturers.

G. Leveling Tolerance: 1/4 inch, up or down, regardless of load and travel direction.

H. Set sills flush with finished floor surface at landing. Fill space under sill solidly with non-shrink, nonmetallic grout.

I. Locate hall signal equipment for elevators as follows, unless otherwise indicated:

1. Place hall lanterns either above or beside each hoistway entrance.
2. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.03 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.04 ADJUSTING

A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

B. Adjust elevators for smooth acceleration and deceleration of car so not to cause passenger discomfort.

C. Adjust doors to prevent opening of doors at landing on corridor side, unless car is at rest at that landing, or is in leveling zone and stopping at that landing.

D. Adjust automatic floor leveling feature at each floor to within 1/4 inch of landing.

3.05 PROTECTION

A. Temporary Use: Limit temporary use for construction purposes to one elevator. Comply with the following requirements for elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

B. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

3.06 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations, adjustments, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions, adjusting and maintaining.

B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

C. Check operation of each elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.07 CLEANING

A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless stall shall be cleaned with soap and water and dried with a non-abrasive surface; shall not be cleaned with bleached-based cleansers.

B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoist way. Remove trash and debris.

3.08 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance during normal working hours.
2. Perform emergency callback service during normal working hours with response time of two hours or less.
3. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Remove and dispose of surface debris as required.
B. Remove and dispose of paving, sidewalk, curbs, etc.
C. Clear site or designated areas of the site of plant life and grass as required, and dispose of as required.
D. Remove and dispose of trees and shrubs as required.
E. Remove and dispose of stumps and root system of trees and shrubs as required.
F. Removal and storage of topsoil.

1.02 RELATED SECTIONS

A. Section 312200 - Earth Moving.
B. Section 329119.13 - Topsoil Placement and Grading: Placement of stored topsoil.

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable local code(s) for disposal of debris.
B. Burning of materials on site is prohibited.
C. Coordinate clearing work with utility companies.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify existing conditions.
B. Identify existing plant life designated to be removed. Verify with Owner and Engineer prior to removal.
C. Verify limits of clearing.

3.02 PROTECTION

A. Locate, identify and protect utilities that are to remain from damage.
B. Protect trees, plant growth and features designated to remain as final landscaping.
C. Protect benchmarks and existing structures from damage or displacement. Any damage to existing structures is to be promptly repaired at no additional cost to the Owner.

3.03 APPLICATION

A. Clear areas required for access to site and execution of work.
B. Remove paving, curbs, debris and sidewalks as required.

C. Remove trees and shrubs designated to be removed. Remove stumps, main root ball, surface rock and perishable debris.

D. Clear undergrowth and dead wood without disturbing subsoil.

E. Remove paving, debris, rock and extracted plant life from site and dispose of in accordance with State and local ordinances.

F. Excavate topsoil from areas to be further excavated, re-landscaped or regraded. Do not excavate wet topsoil.

G. Stockpile topsoil in area designated on site to a height not exceeding 8 feet. Protect from erosion. Remove excess topsoil not being reused from site. Do not remove any topsoil from the site prior to obtaining the approval of the Engineer.

END OF SECTION 311100

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of subsoil.

B. Rough grading and cutting, filing and rough contouring the site for placement of topsoil or pavement base for final grading.

C. Finish grading.

1.02 RELATED REQUIREMENTS

A. Section 311000 - SITE CLEARING.

B. Section 312316 - {\t\#1000092}

C. Section 312323 - {\t\#1000089}: Filling and compaction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: See Section 312323 - {\t\#1000089}.

B. Other Fill Materials: See Section 312323 - {\t\#1000089}.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

D. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.

3.03 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Section 312323 for filling procedures.

G. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 SOIL REMOVAL

A. Stockpile topsoil to be re-used on site; remove remainder from site.

B. Stockpile subsoil to be re-used on site; remove remainder from site.

C. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet (2.5 m); protect from erosion.

3.05 FINISH GRADING

A. Before Finish Grading:

B. Verify subgrade has been contoured and compacted.

C. Remove debris, roots, branches, stones, in excess of 1/2 inch (13 mm) in size. Remove soil contaminated with petroleum products.

D. Where topsoil is to be placed, scarify surface to depth of 3 inches (75 mm).

E. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches (75 mm).

F. Place topsoil in areas where seeding are indicated.

G. Place topsoil where required to level finish grade.

H. Place topsoil to thickness as scheduled.

I. Place topsoil during dry weather.

J. Remove roots, weeds, rocks, and foreign material while spreading.

K. Near plants spread topsoil manually to prevent damage.

L. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

M. Lightly compact placed topsoil.

3.06 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) (30 mm) from required elevation.

B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch) (13 mm).

3.07 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B. Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from Architect as to remedy.

C. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.08 CLEANING

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Removal and storage of subsoil.

B. Cutting, grading, filling and rough contouring the site prior to placement of topsoil or pavement base for final grading.

1.02 RELATED SECTIONS

A. Section 311100 - Site Clearing.

B. Section 312316 - Excavation - Removal of Unsuitable Soils.

C. Section 312323.13 - Backfilling - Replacement of Unsuitable Soils.

1.03 REFERENCES

A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. Rammer and 18 inch Drop.

1.04 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Sieve Analysis: Submit a sieve analysis of all types of fill material to be used.

1.05 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of utilities remaining, by horizontal dimensions, elevations or inverts, and slope gradients.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Subsoil: Reused excavated material, graded, free of lumps, rocks and gravel larger than 3 inches in size, debris and contaminants.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify site conditions.

B. Verify that survey benchmark and intended elevations for the work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours and datum.

B. Identify known underground, aboveground and aerial utilities. Stake and flag locations.

C. Coordinate the removal or relocation of utilities with the necessary utility companies.

D. Protect above and below-grade utilities that are to remain.

E. Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.

F. Protect benchmarks, existing structures, fences, sidewalks, paving and curbs from excavation equipment and vehicular traffic.

3.03 APPLICATION

A. Excavate subsoil from areas to be further excavated or regraded. Do not excavate wet subsoil.

B. Stockpile in area designated on site. Remove excess subsoil not being reused from site.

C. Stockpile subsoil to a height not exceeding 8 feet. Cover to protect from erosion.

D. When excavation through roots is necessary, perform work by hand and cut roots with sharp axe.

E. Fill areas to contours and elevations with unfrozen subsoil material with allowances made for topsoil, aggregate base course or paving.

F. Place and compact subsoil fill material in 12 inch lifts (compacted thickness). Compact to 92 percent maximum dry density in accordance with ANSI/ASTM D1557.

G. Maintain optimum moisture content of fill materials to attain required compaction density.

H. Make grade changes gradual. Blend slope into level areas.

I. Remove surplus fill materials from site.

3.04 TOLERANCES

A. Maximum Variation From Top Surface of Subgrade: 1 inch.

3.05 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014500.

B. Perform tests and analysis of fill material in accordance with ANSI/ASTM D1557.

C. Perform compaction tests at a rate of one for every 10 cubic yards of material placed.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Excavation for building foundations.
B. Excavation for slabs-on-grade, paving and landscaping.
C. Excavation for site structures.
D. Site excavation.

1.02 RELATED SECTIONS

A. Section 312213 - Rough Grading.
B. Section 312323.13 - Backfill: Backfilling excavated material.

1.03 QUALITY ASSURANCE

A. Do not excavate wet or frozen materials without written approval from the Engineer.
B. Provide safety barricades around open excavations.

1.04 FIELD MEASUREMENTS

A. Verify that survey benchmark and intended elevations for the work are as indicated.

1.05 COORDINATION

A. Coordinate work under provisions of Section 013100.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours and datum.
B. Identify known underground, above ground and aerial utilities. Stake and flag locations.
C. Notify utility company to remove or relocate utilities, if required.
D. Protect above and below grade utilities which are to remain.
E. Protect plant life, lawns and other features remaining as a portion of final landscaping.
F. Protect bench marks, existing structures, fences, sidewalks, paving and curbs from excavation equipment and vehicular traffic.
G. Notify the Engineer prior to commencement of excavation.

3.02 EXCAVATION

A. Underpin adjacent structures that may be damaged by excavation work, including utilities and pipe chases.

B. Excavate subsoil required to accommodate landscaping and construction operations to the limits as indicated on the plans.

C. Machine slope banks to angle of repose or less, until shored.

D. Grade top perimeter of excavation to prevent surface water from draining into excavation.

E. Hand trim excavation. Remove loose matter.

F. Remove lumped subsoil, boulders, and rock.

G. Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.

H. Correct unauthorized excavation at no extra cost to Owner in accordance with Section 312323.13.

I. Stockpile excavated material in area designated on site and remove excess material not being reused from site.

J. Sampling and testing of soils in accordance with the NYSDEC soil clean up objectives part 375 is required per New York State. No soils may leave school property without testing. Soil remaining and sabilized on site do not require testing.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014500.

B. Provide for visual inspection of bearing surfaces.

3.04 PROTECTION

A. Protect work under provisions of Section 015000.

B. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

C. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

PART -1 GENERAL

1.01 SECTION INCLUDES

A. Site structure backfilling to sub-grade elevations.
B. Site filling and backfilling.
C. Consolidation and compaction.
D. Fill for over-excavation.
E. Environmental testing.

1.02 RELATED SECTIONS

A. Section 312316 - Excavation.
B. Section 312213 - Rough Grading.

1.03 REFERENCES

A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. Rammer and 18-inch Drop.
B. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes.

1.04 SUBMITTALS

A. Submit under provisions of Section 013300.
B. Material Source: Submit name of imported material suppliers.
C. Provide a letter certifying that each type of imported fill material has been provided by a NYSDEC certified clean fill source or has been tested in accordance with NYSDEC Unrestricted Soil Use Guidelines as defined in Subpart 375-6 Remedial Program Soil Cleanup Objectives.
D. Test Reports: Submit sieve analysis and test results from NYSDEC Unrestricted Soil Use Guidelines for each type of imported fill to be used.

1.05 PROJECT CLOSEOUT SUBMITTALS

A. Submit under provisions of Section 017200.
B. Provide documentation on the contractor’s letterhead certifying that all fill material utilized for this project came from approved sources and met the requirements of the NYSDEC Unrestricted Program Soil Use Guidelines.

PART 2 - PRODUCTS

2.01 IMPORTED FILL SOURCE

A. All imported fill materials shall be provided by a NYSDEC certified clean fill source or meet the requirements of NYSDEC Unrestricted Soil Use Guidelines as defined in Subpart 375-6: Remedial Program Soil Cleanup Objectives.
B. Test samples of imported fill in accordance with the following table:

>1000	Add an additional 2 VOC and 1 composite for each additional 1000 cubic yards or consult with DER

C. Provide materials from the same source throughout the work. Change of source requires approval from the Engineer.

2.02 FILL MATERIALS

A. Coarse Aggregate: Angular crushed or natural stone; washed, free of shale, clay, friable material, sand and debris; graded in accordance with ASTM D2487 Group Symbol GW or GP within the following limits

1. Sieve Size	Percent Passing
a. 1 1/2 inch	100
b. 1 inch	90 - 100
c. 1/2 inch	0 - 15
d. No. 200	0 - 1

B. Pea Gravel: Natural stone; washed, free of clay, shale, organic matter; graded in accordance with ASTM D2487 Group Symbol GC or GM, within the following limits:

1. Minimum Size: ¼ inch.
2. Maximum Size: 5/8 inch.

C. Sand: Natural river or bank sand; washed, free of silt, clay, loam, friable or soluble materials, or organic matter; graded in accordance with ASTM D2487 Group Symbol SW or SP, within the following limits:

1. Sieve Size	Percent Passing
a. No. 4	100
b. No. 14	0 - 100
c. No. 50	5 - 90
d. No. 100	4 - 30
e. No. 200	0

D. Subsoil: Reused, excavated material, graded, free of lumps, rocks and gravel larger than 3 inches in size, debris and contaminants; no more than 15% passing the No. 200 sieve; no more than 30% retained on the ¾" sieve.

E. Drywell Collar Material: Clean sand and gravel containing less than 15% fine sand, silt and clay. Silt and clay fractions are not to exceed 5%. Native material may be reused if it meets this requirement.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate.

B. Verify fill materials to be reused are acceptable.

C. Verify items to be buried during backfilling process have been inspected prior to backfilling.

3.02 PREPARATION

A. Compact subgrade to 92 percent maximum dry density in accordance with ANSI/ASTM D1557.

B. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with sand or subsoil and compact to density equal to or greater than requirements for subsequent backfill material.

3.03 BACKFILLING

A. Backfill areas to contours and elevations with unfrozen materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy materials.

C. Place and compact fill material in 12 inch lifts (compacted thickness). Compact to 92 percent maximum dry density in accordance with ANSI/ASTM D1557.

D. Employ a placement method that does not disturb or damage structures or other items against which material is backfilled.

E. Backfill against supported structures. Do not backfill against unsupported structures.

F. Backfill simultaneously on each side of structure.

G. Make grade changes gradual. Blend slope into level areas.

H. Remove surplus backfill materials from site.

I. Leave fill material stockpile areas completely free of excess fill materials.

3.04 TOLERANCES

A. Maximum Variation From Top Surface of Backfilling Under Paved Areas: 1/4 inch.

B. Maximum Variation From Top Surface of General Backfilling: 1 inch.

3.05 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014500.

B. Perform field tests and analysis of fill material in accordance with ANSI/ASTM D1557.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

D. Unless additional testing is required by the Engineer, compaction tests shall be taken at the following rates:

1. Pavement Subgrade: One test per 5,000 square feet of subgrade immediately prior to placing subbase.

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Excavate trenches for piping and utilities.

B. Compacted bedding and backfill around and over piping and utilities to subgrade elevations.

C. Backfilling and compaction.

1.02 RELATED SECTIONS

A. Section 312213 - Rough Grading: Topsoil removal from site surface.

1.03 REFERENCES

A. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

B. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb Rammer and 18-inch Drop.

1.04 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Test Reports: Submit a sieve analysis for backfill to be used.

1.05 QUALITY ASSURANCE

A. Do not excavate wet or frozen materials without written approval from the Engineer.

B. Do not backfill over or with wet or frozen materials.

C. Provide safety barricades around open excavations.

1.06 FIELD MEASUREMENTS

A. Verify that survey benchmark and intended elevations for the work are as shown on plans.

1.07 COORDINATION

A. Coordinate work under provisions of Section 013100.

B. Coordinate trenching with installation of pipe or conduit.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Subsoil: Reused, excavated material, graded, free of lumps, rocks and gravel larger than 3 inches in size, debris and contaminants.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing site conditions and substrate.

B. Verify fill materials to be reused are acceptable.

C. Verify items to be buried during backfilling process have been inspected prior to backfilling.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Maintain and protect existing utilities remaining which pass through work area.

C. Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.

D. Protect benchmarks, existing structures, fences, sidewalks, paving and curbs from excavation equipment and vehicular traffic. Any item damaged by the contractor shall be promptly repaired at the contractor's expense.

E. Protect above and below grade utilities which are to remain.

F. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with subsoil fill and compact to density equal to or greater than requirements for subsequent backfill material.

3.03 EXCAVATION

A. Excavate subsoil required for piping.

B. Cut trenches to the dimensions shown on the plans.

C. Excavation shall not interfere with normal 45 degree bearing splay of foundations.

D. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

E. Remove lumped subsoil, boulders, and rock.

F. For trenches made in solid rock, excavate to a depth of 1 foot below the proposed pipe invert.

G. Correct unauthorized excavation at no cost to Owner in accordance with Section 312323.13.

H. Stockpile excavated material in area designated on site and remove excess material not being used from site. Remove excavated material from site.

3.04 BACKFILLING

A. Support pipe and conduit during placement and compaction of fill material.

B. For trenches made in solid rock, place an additional 1 foot of fill material under pipe or conduit.

C. Place fill material to the dimensions and limits as shown on the plans.

D. Place and compact fill material in 12 inch lifts (compacted thickness) for depths greater than 2 feet and 6 inch lifts (compacted thickness) for depths less than 2 feet. Compact to 92 percent maximum dry density in accordance with ANSI/ASTM D1557.

E. Place fill material simultaneously on both sides of the pipe or conduit. Backfill to the dimensions and limits shown on the plans with reused subsoil.

F. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

G. Place and compact material in continuous layers not exceeding 6 inches compacted depth.

H. Employ a placement method that does not disturb or damage conduit or pipe.

3.05 TOLERANCES

A. Maximum Variation From Top Surface of Backfilling Under Paved Areas: 1/4 inch.

B. Maximum Variation From Top Surface of General Backfilling: 1 inch.

3.06 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014500.

B. Perform field tests and analysis of fill material in accordance with ANSI/ASTM D1557.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

D. Unless additional testing is required by the Engineer, compaction tests shall be taken at the springline of the pipe and after each lift at 100 foot intervals along the pipe run.

3.07 CLEANING

A. Remove surplus backfill materials from site.

B. Leave fill material stockpile areas completely free of excess fill materials.

3.08 PROTECTION

A. Protect finished work under provisions of Section 015000.

B. Recompact fills subjected to vehicular traffic.

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Asphaltic concrete paving; wearing, binder or base course.

1.02 RELATED SECTIONS

A. Section 321123.16 - Recycled Concrete Aggregate Base Course.

1.03 REFERENCES

A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.

B. AI MS-8 - Asphalt Paving Manual.

C. ASTM D242 - Mineral Filler for Bituminous Paving Mixtures.

D. ASTM D546 - Test Method for Sieve Analysis of Mineral Filler for Road and Paving Materials.

1.04 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Supplier: Submit name of asphalt supplier to be used on the project prior to placement of any asphalt on the project.

C. Design Data: Submit asphalt mix design for each asphalt type to be used.

D. Testing Firm: Submit name of testing firm to be performing tests on asphalt pavement.

1.05 QUALITY ASSURANCE

A. Obtain materials from the same supplier throughout the duration of the project.

B. Do not alter from mix design requirements.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle products to the site under provisions of Section 016500.

B. Deliver asphalt in sealed, metal containers covered with suitable material to protect the asphalt from the elements.

C. Lightly lubricate the inside surface of the container with a thin oil or soap solution before loading asphalt.

D. All containers must be cleaned of all foreign materials prior to loading.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when base surface temperature is less than 40 degrees F, or if surface is wet or frozen.

B. Do not place asphalt when precipitation is occurring.

PART 2 - PRODUCTS

2.01 2.01 - MATERIALS

A. Asphalt Cement: AC-20; homogeneous, and shall not foam when heated to 347 degrees F.

B. Fine Aggregate: Material passing the 1/8 inch sieve; natural sand of hard, strong, durable particles which are free from coatings or injurious amounts of clay, loam or other deleterious substances.

C. Coarse Aggregate: Material retained on the 1/8 inch sieve; crushed stone or gravel; clean, durable, sharp angled fragments of rock of uniform quality.

D. Mineral Filler: ASTM D242, finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter; 100 percent shall pass the No. 30 sieve; a minimum of 85 percent shall pass the No. 80 sieve; and a minimum of 65 percent shall pass the No. 200 sieve as measured in accordance with ASTM D546.

2.02 2.02 - EQUIPMENT

A. Rollers: Minimum weight of 10 tons; equipped with lubricating devices for the roller wheels.

B. Pavers: Equipped with a vibratory device.

2.03 2.03 - ACCESSORIES

A. Tack Coat: Homogeneous, medium curing, liquid asphalt.

B. Wheel Lubricant: Oil-water mixture containing maximum 10 percent lubricating oil.

2.04 2.04 - MIXES

A. Use dry material to avoid foaming. Mix uniformly.

B. Base Course: NYSDOT Type 1; 4.0 to 6.0 percent of asphalt cement by weight in mixture in accordance with the following gradation:

SIEVE SIZE	PERCENT PASSING
2 INCHES	100
1 ½ INCHES	90-100
1 INCH	78-95
½ INCH	57-84
¼ INCH	40-72
1/8 INCH	26-57
NO. 20	12-36
NO. 40	8-25
NO. 80	4-16
NO. 200	2-8

A. Binder Course: NYSDOT Type 3; 4.5 to 6.5 percent of asphalt cement by weight in mixture in accordance with the following gradation:

Sieve Size	Percent Passing
1-1/2 inches	100
1 inch	95-100

1/2 inch	70-90
1/4 inch	48-74
1/8 inch	32-62
No. 20	15-39
No. 40	8-27
No. 80	4-16
No. 200	2-8

B. Wearing Course: NYSDOT Type 6; 5.8 to 7.0 percent of asphalt cement by weight in mixture in accordance with the following gradation:

Sieve Size	Percent Passing
1 inch	100
1/2 inch	95-100
1/4 inch	65-85
1/8 inch	36-65
No. 20	15-39
No. 40	8-27
No. 80	4-16
No. 200	3-6

2.05 SOURCE QUALITY CONTROL

A. Obtain asphalt materials from same source throughout the project.

B. Provide asphalt in accordance with the approved mix design for each type of asphalt.

C. Test samples in accordance with AI MS-2.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate.

B. Verify that compacted subbase is dry and ready to receive work of this section.

C. Verify gradients and elevations of base are correct.

D. Verify that all castings are properly installed and are at the correct elevations.

E. Beginning of installation means installer accepts existing conditions.

3.02 PREPARATION

A. Apply tack coat at uniform rate of 0.03 to 0.07 gal/sq. yd. to contact surfaces of castings, curbs, gutters and any asphalt or concrete material.

B. Do not apply tack coat to wet or frozen surfaces.

C. Coat top surfaces of castings with oil to prevent bond with asphalt pavement.

3.03 INSTALLATION

A. Install work in accordance with AI MS-8.

B. Maintain asphalt temperature between 250 and 325 degrees F during placement.

C. Place asphalt within 24 hours of applying tack coat.

D. Place asphalt to compacted thicknesses as identified on plans. If a multiple course pavement is to be used, place top course within 24 hours of placing bottom course. If more than 24 hours elapse, a tack coat will be required to be placed over the entire surface of the bottom course prior to any additional paving.

E. Utilize the vibratory device on the paver at all times.

F. Compact pavement by rolling. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

G. Compact pavement to a minimum of 94% maximum density.

H. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.

I. Seal all joints between new pavement and existing pavement with asphalt cement.

3.04 TOLERANCES

A. Maximum Variation From Flatness: 1/8 inch measured with 10 foot straight edge.

B. Maximum Variation From Scheduled Compacted Thickness: 1/8 inch.

C. Maximum Variation from True Elevation: 1/4 inch.

3.05 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014500.

B. Take samples and perform tests in accordance with AI MS-2.

C. Test are to include percent compaction, gradation and asphalt content.

D. Provide an asphalt thermometer for determining the asphalt temperature during paving operations.

E. Frequency of Tests: One test for every 1,000 square feet of each pavement course.

3.06 PROTECTION

A. Protect finished work under provisions of Section 015000.

B. Immediately after placement, protect pavement from mechanical injury until project is accepted by the Owner.

END OF SECTION 321216

PART 1- GENERAL

1.01 SECTION INCLUDES

A. These basic requirements apply to all Division 22000 Sections.

B. The work of this Section consists of providing of all materials, labor and equipment and the like necessary and/or required for the complete execution of all Plumbing and related work for this project, as required by the contract documents.

1.02 RELATED SECTIONS

A. Refer to Division 1 Specification.

1.03 REFERENCES

A. ASHRAE – American Society of Heating, Refrigerating and Air Conditioning Engineers Guides and Standards, latest editions.

B. ASPE - American Society of Plumbing Engineers.

C. UL - Underwriters Laboratory.

D. NFPA - National Fire Protection Association.

1.04 REGULATORY REQUIREMENTS

A. 2025 NY State Building Code
B. 2025 NY State Plumbing Code.
C. NY State Education Department Facility guidelines
D. Obtain permits, and request inspections from authority having jurisdiction.

1.05 QUALITY ASSURANCE

A. The Contractor shall have the work indicated on the drawings and/or specified in each section performed by vendors or mechanics experienced and skilled in its implantation or by a “Specialist”, “Specialty Contractor” or “Specialty Subcontractor” under contractual agreement with the Contractor. These terms mean an individual or firm of established reputation, or, if newly organized, whose personnel have previously established a reputation in the same field, which is regularly engaged in, and which maintains a regular force of workmen skilled in either manufacturing or fabricating items required by the Contract, installing items required by the Contract, or otherwise performing work required by the Contract.

B. Where the Contract Specifications require installation by a "Specialist," that term shall also be deemed to mean either the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform such work under the manufacturer's direct supervision.

1.06 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed arrangement of Work to meet Project conditions, including changes to Work specified in other Sections.

1.07 SCOPE OF WORK

A. This Contractor shall be responsible for coordinating his work with all other trades.

B. The Contractor shall provide all materials, labor, equipment, tools, appliances, services, hoisting, scaffolding, supervision and overhead for the furnishing and installing of all mechanical work and related work including but not limited to the following:

- Plumbing Fixtures
- Piping, Valves and fittings and specialties
  - Domestic systems
  - Drain, Waste, and Vent
  - Gas pipe valves and specialties
- Hangers and Supports
- Pipe Insulation
- Identification
- Coordination
- Phasing
- Shop Drawings
- As-Built Drawings and Maintenance Manuals
- Warrantees

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 GENERAL

A. Construct all apparatus of materials and pressure ratings suitable for the conditions encountered during continuous operation.

B. Where corrosion can occur, appropriate corrosion resistant materials and assembly methods must be used including isolation of dissimilar metals against galvanic interaction. Resistance to corrosion must be achieved by the use of the appropriate base materials. Coatings shall be restored to only when specifically permitted by the Specification.

C. Construct all equipment in accordance with requirements of all applicable codes. All pressure vessels and safety devices that fall within the scope of the ASME Code shall conform to the Code and bear the ASME label or stamp.

D. Match and balance all system components to achieve compatibility of equipment or satisfactory operation and performance throughout the entire operating temperature and control ranges. All installations shall be in accordance with manufacturer's recommendations.

E. The contractor shall warranty all work, including labor and materials, and equipment furnished and installed as part of this contract for a minimum period of year from the date of acceptance by the owner, in writing. Certain equipment, such as underground fuel tanks, may have longer warranties as indicated in the specifications. In such cases the longer of the two warranties shall prevail.

F. All piping, fittings, faucets, valves, and water fixtures that are in contact with potable water shall be lead-free in compliance with NSF/ANSI 372.

3.02 SHOP DRAWINGS AND SUBMITTALS (COORDINATE WITH DIVISION 1)

A. Shop drawings and samples shall be prepared and submitted in accordance with the requirements established in the contract and shall consist of all items listed in the following paragraph.

B. Manufacturer's data or shop drawings giving full information as to dimensions, materials, and all information pertinent to the adequacy of the submitted equipment shall be submitted for review. Shop drawings shall include, but not be limited to the following:

C. Submit all equipment noted and scheduled on plans including but not limited to the following:

- Plumbing Fixtures
- Piping, Valves and fittings and specialties
  - Domestic systems
  - Drain, Waste, and Vent
  - Gas systems
- Hangers and Supports
- Pipe Insulation
- Hangers and Inserts
- Insulation
- Piping Layout (3/8 scale)

C. The contractor shall, upon award, submit a schedule for the engineer’s review indicating when each of the above shop drawings shall be submitted. Submittals shall be made in a timely manner as the project progresses in accordance with the Construction manager or General contractor’s work schedules. The contractor shall allow sufficient time for the engineers to perform his review. A minimum of 10 business days shall be required. Untimely submittals shall be cause for the owner to make a delay against the contractor.

D. Demolition, purchase and or installation shall not begin until shop drawings pertaining to the equipment associated with any related potion of the work have been submitted.

E. Coordination shop drawings shall indicate all new lights, walls, piping, ductwork, structural elements, existing work, etc. and dimension locations of plumbing piping including elevations in relation to these items.

F. Where shop drawings have been reviewed by the Engineer, such review shall not be considered as a guarantee of measurements or building conditions. Where drawings have been reviewed, said review does not mean that drawings have been checked in detail; said review does not substantiate any quantities and in any way relieve the Contractor from his responsibility nor the necessity of furnishing materials or performing work required by the Contract Drawings and Specifications.

G. The Contractor shall be specifically responsible for checking dimensions and clearances and confirming that roof drains will connect properly to the new roof and/or materials.

H. Drawings marked "Make Corrections Noted" give authority to proceed in accordance with the notes. However, if drawings are also marked "Resubmit", corrected drawings must be resubmitted for final review.

I. Drawings marked "Rejected" do not give authority to proceed with any portion of the work shown there-on. Drawings must be resubmitted.

3.03 CHARTS AND TAGS

A. The Contractor shall provide three sets of charts and diagrams of all piping systems indicating the number and location of valves, etc.

B. All valves shall be designated with brass tags.

C. Comply with Division 1.

3.04 CODES AND STANDARDS

A. All equipment and installation methods shall conform to the applicable standards and/or recommendations set forth in but not limited to the following;
- The New York State Building, Plumbing, and Energy Conservation Code
- NYS SED Manual of Planning Standards.

B. As well as all applicable referenced standards.

3.05 FEES & PERMITS

A. The Contractor shall obtain all permits and pay all fees required for his work.

3.06 PAINTING

A. All piping shall be painted in colors conforming with OSHA Standards.

3.07 CUTTING AND PATCHING

A. All cutting and patching required for piping, etc., passing through walls, floors, and roof shall be provided by the General Contractor under this contract unless otherwise noted. This Contractor shall be responsible for any damage done to the structure due to his negligence.

B. Patching materials and application shall match existing construction.

C. Where applicable, new holes for piping installation shall be core drilled.

D. Pipe Sleeves & Fire-stopping

1. Provide for all pipes and other elements passing through floors, walls, partitions and structural elements, sleeves as specified. Sleeves shall be of adequate diameter to allow for a minimum of 3/4 inches clear all around sleeve and pipe.
2. Where pipes penetrate fire rated assemblies, or where holes or voids are created to extend systems through fire rated assemblies (walls, floors, ceilings, structure, etc.); sleeves and fire-stopping systems shall be installed.

3.08 PROTECTION-COORDINATE WITH DIVISION 1

A. Recommendations and Provisions of ANSI Bulletin A10.2 and OSHA shall be complied with in-so-far as applicable to the work.

C. The Contractor shall provide temporary partitions or tarpaulins to protect adjacent spaces and/or equipment. He shall be responsible for any damage or injury to person or

property of any character resulting from any act, omission, neglect or misconduct in his manner or method of executing his work.

D. The Contractor shall restore at his own expense such property to a condition similar or equal to that existing before such damage or injury in an acceptable manner.

E. The Contractor, furthermore, shall conduct his operations in such a manner as to prevent dust and debris from transferring on to adjoining property or into existing spaces.

F. All openings cut in walls, floors, roof or ceilings of the building, for pipe, etc., shall be closed off with box-type temporary protective enclosures of ¼" tempered hardboard, except when mechanics are actually working at the particular opening. Enclosures shall be constructed of fireproof 2x4 frame, four (4) sides covered and made completely dust and watertight.

G. All finished floor areas through which the contractor must pass with materials or equipment shall be protected with a layer of ¼" hardboard, "Masonite", laid with joints taped together.

3.09 WELDING

A. Welding and equipment shall conform to the American Welding Society's Code for Welding in Building Construction, latest edition as well as state and local laws and ordinances.

B. The handling and storage of all welding materials, acetylene and oxygen tanks, burners, and other equipment required for the execution of welding and cutting work shall be subject at all times to the approval of the Owner and/or Architect. All welding materials and gas tanks shall be promptly removed from the premises upon completion of each day's work or stored in a manner satisfactory to the owner. Welding and equipment shall conform to the American Welding Society's Code for Welding in Building Construction, latest edition as well as state and local laws and ordinances.

3.10 AS-BUILT DRAWINGS

A. The Contractor shall provide a complete set of As-Built drawings showing actual installation and locations of all piping and roof drains.

B. As-Built drawings shall be submitted as per contract requirements in accordance with Division 1.

3.11 CONDITIONS

A. Inspection: Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Verify that the work of this Section may be completed in strict accordance with all pertinent codes and regulations, the approved Shop Drawings, and the Manufacturers' recommendations.

C. Discrepancies: In the event of discrepancy, immediately notify the Engineer. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

3.12 INSTALLATION OF EQUIPMENT

A. Locations: Install all equipment in the locations shown on the approved Shop Drawings except where specifically otherwise approved on the job by the Owner and/or Engineer.

B. Interferences: Avoid interference with structure, and with work of other trades, preserving adequate headroom and clearing all doors and passageways to the approval of the Engineer.

C. Inspection: Check each piece of equipment in the system for defects, verifying that all parts are properly furnished and installed, and that all items function properly, and that all adjustments have been made.

3.13 CLOSING-IN OF UNINSPECTED WORK

A. General: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and accepted by the Engineer and by all other authorities having jurisdiction.

B. Uncovering: Should any of the work of this Section be covered up or enclosed before it has been completely inspected, tested, and approved, do all things necessary to uncover all such work. After the work has been completely inspected, tested, and approved, provide all materials and labor necessary and make all repairs necessary to restore the work to its original and proper condition at no additional cost to the owner.

3.14 BUILDING ACCESS

A. The Contractor shall inform himself fully regarding peculiarities and limitations of space available for the passage and installation of all equipment and materials under the Contract.

B. Verify and coordinate removal of existing construction to suit conditions. Provide all labor and material to facilitate installation.

3.15 COOPERATION WITH OTHER TRADES / PHASING

A. Cooperate with other trades in order that all systems in the work may be installed in the best arrangements.

D. Coordinate as required with all other trades to share space in common areas and to provide the maximum of access to each system.

E. This Contractor shall submit fully coordinated shop drawings showing all piping, ductwork and equipment, as well as relevant work of all other trades such as light, conduits, structural and steel, which may impact the final size or placement of piping, roof drains, etc.

F. The work shall be scheduled and phased in accordance with the requirements of the contract and the client. Prior to the commencement of work the PLUMBING contractor shall submit a schedule in writing to the Architect and owner for approval. There shall be no shutdowns of any systems without prior written approval from the owner. The contractor shall include in his bid all costs associated with providing temporarily piping, pumps, hot water heaters, to maintain operations outside the area of work while work is being performed.

3.16 CLEANING

A. It is the intent of the contract documents that all work, including the inside of equipment be left in a clean condition. All construction dirt shall be removed from material and equipment.

B. All removed items shall be taken off the premises and discarded in a manner satisfactory to the Owner.

3.17 COMPLETENESS

A. It is the intent of the contract documents to provide complete systems. Completeness shall mean not only that all material and equipment has been installed properly, but that all material and equipment is installed, adjusted, and operating as per the design intent in the opinion of the Engineer.

3.18 FIRE PREVENTION DURING HOT WORK

A. Before starting operations, the Contractor shall furnish trained personnel to provide fire watches for locations where hot work is to be performed. One fire watcher may observe several locations in a relatively small contiguous area. Contractor shall furnish suitable type, fully-charged, operable portable fire extinguisher to each fire watcher.

B. The Contractor shall provide fire watchers who know how to operate the fire extinguisher, how to turn on a fire alarm and how to summon the fire department.

C. Before starting operations, take suitable precautions to minimize the hazard of a fire communicating to the opposite side of walls, floors, ceilings and roofs from the operations.

3.19 SAFETY MEASURES

A. Hot work shall not be done in or near rooms or areas where flammable liquids or explosive vapors are present or thought to be present. A combustible gas indicator (explosimeter) test shall be conducted to assure that each area is safe. The Contractor is responsible for arranging and paying for each test.

B. Insofar as possible, the Contractor shall remove and keep the area free from all combustibles, including rubbish, paper and waste within a radius of 25 feet from hot operations.

C. If combustible material cannot be removed, the Contractor shall furnish fireproof blankets to cover such materials. At the direction of the owner floors, walls, and ceilings of combustible material shall be wetted thoroughly with water before, during, and after operations sufficiently to afford adequate protection.

D. Where possible, the Contractor shall furnish and use baffles of metal or gypsum board to prevent the spraying of sparks, hot slag and other hot particles into surrounding combustible material.

E. The Contractor shall prevent the spread of sparks and particles of hot metal through open windows, doors, and holes and cracks in floors, walls, ceilings and roofs.

F. Cylinders of gas used in hot work shall be placed a safe distance from the work. The Contractor shall provide hoses and equipment free of deterioration, malfunction and leaks. Suitable supports shall be provided to prevent accidental overturning of cylinders. All cylinder control valves shall be shut off while in use with the gas pressure regulator set at 15 psi or less.

G. When hot work operations are completed or ended for the day, each location of the day's work shall be inspected by the Contractor 30 to 60 minutes after completion of operations to detect for hidden or smoldering fires and to ensure that proper housekeeping is maintained. Contractor shall clean up the area of work at the end of each shift or workday.

H. Where sprinkler protection exists, the sprinkler system shall be maintained without interruption while operations are being performed. If operations are performed close to automatic sprinkler heads, gypsum board sheets or damp cloth guards may be used to shield the individual heads temporarily. The heads shall be inspected by the Contractor immediately after hot work operations cease, to ensure all materials have been removed from the heads and that the heads have not been damaged.

I. Suitable type, fully-charged, operable portable fire extinguisher shall be available at all times during hot work operations.

J. If any of the above safeguards are not employed, or are violated, the Contracting owners Representative may, by written notice, stop the work until compliance is obtained. Such stoppage shall not relieve the Contractor form performing his work within the Contract period for the Contract price.

3.20 USE OF OWNERS EQUIPMENT

K. The contractor shall not use any of the owner's HVAC system or equipment, new or existing, for any purpose. The contractor shall provide temporary HVAC equipment, ductwork, power, and controls for use during construction for the purpose of ventilation or heating during the construction process. All such equipment, ductwork, power, and controls shall be removed and the completion of work.

END OF SECTION

PART 1 - ENERAL

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. Packless expansion joints.
2. Alignment guides and anchors.
3. Pipe loop and swing expansion connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal: For each anchor and alignment guide, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For expansion joints to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

2.2 PACKLESS EXPANSION JOINTS

A. Flexible-Hose Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Flexicraft Industries.
    b. Mason Industries, Inc.
    c. Metraflex Company (The).

2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
4. Ratings: Pressure and temperature ratings to suit the systems in which these devices are installed.
5. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.

    a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
    b. Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F and 500 psig at 450 deg F ratings.

6. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with solder-joint end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F and 315 psig at 450 deg F ratings.

B. Rubber Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Mason Industries, Inc.
    b. Metraflex Company (The).
    c. Tozen Corporation.

2. Standards: ASTM F1123 and FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
3. Material: Fabric-reinforced rubber complying with FSA-PSJ-703.
4. Spherical Type: Single or multiple spheres with external control rods.
5. Minimum Pressure Ratings:

    a. NPS 1-1/2 to NPS 4: 150 psig at 220 deg F.
    b. NPS 5 to NPS 6: 140 psig at 200 deg F.
    c. NPS 8 to NPS 12: 140 psig at 180 deg F.

6. Material for Water: Buna-N.
7. End Connections: Full-faced, integral steel flanges with steel retaining rings.

2.3 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Adsco Manufacturing LLC.
    b. Advanced Thermal Systems, Inc.
    c. Flexicraft Industries.
    d. Metraflex Company (The).

2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A36/A36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A183, steel hex head.
3. Washers: ASTM F844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
    a. Expansion Plug: Zinc-coated steel.
    b. Washer and Nut: Zinc-coated steel.

5. Chemical Fasteners: Insert-type stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.

    a. Bonding Material: ASTM C881/C881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
    b. tud: ASTM A307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
    c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 INSTALLATION OF EXPANSION JOINTS

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install rubber packless expansion joints according to FSA-PSJ-703.

3.2 INSTALLATION OF PIPE LOOP AND SWING CONNECTIONS

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.

C. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.

D. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.3 INSTALLATION OF ALIGNMENT-GUIDES AND ANCHORS

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install one guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe, and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24; U bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.
6. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.

B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded waterstop collar.

C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

E. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, Dura-coated or Duco-coated cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig minimum.
3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633 of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

B. Plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.6 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

5. Use silicone sealant to seal the space around outside of stack-sleeve fittings.

B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Use grout or silicone sealant to seal the space around outside of sleeve-seal fittings.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6: Sleeve-seal fittings.
b. Piping NPS 6 and Larger: Sleeve-seal fittings.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.
b. Piping NPS 6 and Larger: Steel pipe sleeves.

5. Interior Partitions:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
    c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
    e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
    f. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
    g. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with concealed hinge.

2. Escutcheons for Existing Piping in new or renovated spaces.

    a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
    b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
    c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    e. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge.
    f. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with concealed hinge.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken or damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

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. Brass ball valves.
2. Bronze lift check valves.
3. Bronze swing check valves.
4. Bronze gate valves.
5. Iron gate valves.
6. Bronze globe valves.
7. Iron globe valves.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Non-rising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set gate valves closed to prevent rattling.
4. Set ball valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:
1. Handwheel: For valves other than quarter-turn types.
2. Handlever: For quarter-turn valves NPS 6 and smaller.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Seats: PTFE or TFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

B. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Seats: PTFE or TFE.
g. Stem: Brass.

h. Ball: Chrome-plated brass.
i. Port: Regular.

2.3 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Disc: Bronze.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Disc: Bronze.

2.5 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. Crane Co.; Crane Valve Group; Stockham Division.
   d. Milwaukee Valve Company.
   e. NIBCO INC.
   f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig.
   c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
   d. Ends: Threaded or solder joint.
   e. Stem: Bronze.
   f. Disc: Solid wedge; bronze.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. Crane Co.; Crane Valve Group; Stockham Division.
   d. Hammond Valve.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 300 psig.
   c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
   d. Ends: Threaded or solder joint
   e. Stem: Bronze.
   f. Disc: Solid wedge; bronze.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron, bronze, or aluminum.

2.6 IRON GATE VALVES

A. Class 150, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Crane Co.; Crane Valve Group; Stockham Division.
    d. Milwaukee Valve Company.
    e. NIBCO INC.
    f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-70, Type I.
    b. CWP Rating: 200 psig.
    c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    d. Ends: Flanged.
    e. Trim: Bronze.
    f. Disc: Solid wedge.
    g. Packing and Gasket: Asbestos free.

B. Class 250, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Stockham Division.
    c. Milwaukee Valve Company.
    d. NIBCO INC.
    e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-70, Type I.
    b. CWP Rating: 500 psig.
    c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    d. Ends: Flanged.
    e. Trim: Bronze.
    f. Disc: Solid wedge.
    g. Packing and Gasket: Asbestos free.

2.7 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: Bronze, PTFE, or TFE
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

2.8 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge, pin level.
2. Lift Check Valves: With stem upright and plumb.

F. All valves used in any system shall have a pressure class that exceeds the pressure of the system it is installed in.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated on plan, use the following:

1. Shutoff Service: Ball, butterfly, or gate valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service: Globe or ball valves.
4. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.

b. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
5. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 ½"and Smaller:

1. Brass or Bronze body Valves: May be provided with lead free solder-joint ends instead of threaded ends.
2. Ball Valves: Two-piece, full port, brass with brass trim. Class 150
3. Bronze Swing Check Valves: Class 150, bronze disc.
4. Bronze Gate Valves: Class 150.

B. Pipe NPS 3" and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM, NBR seat, aluminum-bronze disc.
3. Iron, Grooved-End Butterfly Valves: 175 CWP.
4. Iron Gate Valves: Class 150.

3.6 SANITARY WASTE AND STORM-DRAINAGE VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Swing Check Valves: Class 150, nonmetallic disc.
3. Bronze Gate Valves: Class 150.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.

2. Iron Gate Valves: Class 150.
3. Iron Swing Check Valves: Class 150.
4. Iron Globe Valves: Class 150.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

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. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe stands.
6. Pipe positioning systems.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 fire-suppression piping Sections for pipe hangers for fire-suppression piping.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following: include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Pipe stands.

C. Delegated-Design Submittal: For trapeze hangers 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. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

D. Welding certificates.

1.6 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

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. National Pipe Hanger Corporation.
   2. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
   3. Rilco Manufacturing Co., Inc.
   4. Other manufacturers offering equivalent products.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

   1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
   2. Base: Stainless steel.
   3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
   4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

2.6 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Stand Installation:

1. Pipe Stand: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

F. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.3 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections**.**

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, and metal trapeze pipe hangers and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Equipment labels
   2. Warning signs and labels.
   3. Pipe labels.
   4. Stencils.
   5. Valve tags.
   6. Warning tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to be included in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass 0.032-inch, stainless steel 0.025-inch, aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: As per ANSI depending on service.
3. Background Color: as per ANSI depending on service.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: as per ANSI depending on service.
3. Background Color: ANSI depending on service.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Black.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Pre-coiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Paint: Exterior, gloss, black unless otherwise indicated. Paint may be in pressurized spray-can form.
2. Identification Paint: Exterior, enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule:

1. Low-Pressure Compressed Air Piping:

   a. Background: Safety blue.
   b. Letter Colors: White.

2. High-Pressure Compressed Air Piping:

   a. Background: Safety blue.
   b. Letter Colors: White.

3. Domestic Water Piping

   a. Background: Safety green.
   b. Letter Colors: White.

4. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: Safety black
   b. Letter Color: White

3.3 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

    a. Cold Water: 1-1/2 inches round.
    b. Hot Water: 1-1/2 inches round.
    c. Sanitary waste and storm drainage: 1-1/2 inches round.

2. Valve-Tag Color:

    a. Cold Water: Green.
    b. Hot Water: Green.
    c. Sanitary waste and storm drainage: Natural.

3. Letter Color:

    a. Cold Water: White.
    b. Hot Water: White.
    c. Sanitary waste and storm drainage: white.

3.4 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Sanitary waste piping exposed to freezing conditions.
5. Storm-water piping exposed to freezing conditions.
6. Roof drains and rainwater leaders.
7. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section 221116 "Domestic Water Piping."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Detail removable insulation at piping specialties, equipment connections, and access panels.
5. Detail application of field-applied jackets.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Jacket Materials for Pipe: 12 inches long by NPS 2.
3. Sheet Jacket Materials: 12 inches square.

4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

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. Pittsburgh Corning Corporation; Foamglass.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.

6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

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. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

I. Mineral-Fiber, Preformed Pipe Insulation:

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. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000-Degree Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

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. Ramco Insulation, Inc.; Super-Stik.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

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. Ramco Insulation, Inc.; Thermokote V.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

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. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

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. Aeroflex USA, Inc.; Aeroseal.
    b. Armacell LLC; Armaflex 520 Adhesive.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
    d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. PVC Jacket Adhesive: Compatible with PVC jacket.

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. Dow Corning Corporation; 739, Dow Silicone.
b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass and Phenolic Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

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. Johns Manville; Zeston.
    b. P.I.C. Plastics, Inc.; FG Series.
    c. Proto Corporation; LoSmoke.
    d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
    b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
    c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
d. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil- thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

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. Pittsburgh Corning Corporation; Pittwrap.
b. Polyguard Products, Inc.; Insulrap No Torch 125.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

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. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

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. ABI, Ideal Tape Division; 491 AWF FSK.
    b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    c. Compac Corporation; 110 and 111.
    d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

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. ABI, Ideal Tape Division; 370 White PVC tape.
    b. Compac Corporation; 130.
    c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

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. ABI, Ideal Tape Division; 488 AWF.
    b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    c. Compac Corporation; 120.
    d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.8 SECUREMENTS

A. Bands:

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. ITW Insulation Systems; Gerrard Strapping and Seals.
    b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

2.9 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
    b. McGuire Manufacturing.
    c. Truebro; a brand of IPS Corporation.
    d. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Truebro; a brand of IPS Corporation.
    b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch - wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe

insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 FINISHES

A. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

B. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. Smaller than NPS 1 ½": Insulation shall be one of the following:

a. Cellular Glass: ½ inches thick.
b. Flexible Elastomeric: 1/2 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1 1/2 and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1" inches thick.
b. Flexible Elastomeric: 1" inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.

B. Domestic Hot and Recirculated Hot Water: (T < 140° F)

1. Smaller than NPS 1 ½": Insulation shall be one of the following: (T < 140° F)

a. Cellular Glass: 1 inch thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1 ½" and Larger: Insulation shall be one of the following: (T < 140° F)

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1-1/2 inches thick.
Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

C. Domestic Hot and Recirculated Hot Water: (T 141°F to 200° F)
1. Smaller than NPS 1 ½": Insulation shall be one of the following:

a. Cellular Glass: 11/2" inch thick.
b. Flexible Elastomeric: 1 ½" inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 11/2" inch thick.

2. NPS 1 ½" and Larger: Insulation shall be one of the following:

a. Cellular Glass: 2 inches thick.
b. Flexible Elastomeric: 2 inches thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

D. Roof Drain Bodies and storm risers and horizontal offsets inside building:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 11/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. All Sanitary waste, storm and domestic piping in garages or areas not heated:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 2" inches thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inch thick.

F. Domestic Chilled Water (Potable):

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch

G. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 1/2 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
c. Jacket with protective shielding guards. Refer to section 2.9

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. ASJ

D. Piping, Exposed:

1. All exposed sanitary, waste, storm, hot water cold water, and vent piping and fittings which are exposed to view in garages, public areas, (as well as insulated piping in equipment rooms), shall be completely covered with white Zeston 2000 PVC insulated piping and fitting covers. Apply as per manufacturer with perma weld adhesive. All labels and flow arrows shall be applied over PVC jacket.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Copper tube and fittings
2. Ductile iron pipe and fittings
3. Pipe joining materials
4. Specialty valves
5. Transition fittings
6. Dielectric fittings.

B. Related Section:

1. Division 22 Section "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.3 SUBMITTALS

A. Product Data: For the following products:

1. Specialty valves.
2. Transition fittings.
3. Dielectric fittings.
4. Flexible connectors.

B. Water Samples: Specified in "Cleaning" Article.

C. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Fire-suppression-water piping.
2. Domestic water piping, storm water piping and sanitary piping.
3. HVAC hydronic piping and Ductwork.
4. Electrical conduits.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager, Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Construction Manager's, Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

C. Comply with NSF Standard 372 for lead-free material.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

B. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

C. Copper, Brass, or Bronze Pressure-Seal-Joint Fittings:
1. Fittings: Cast-brass, cast-bronze or wrought-copper with EPDM O-ring seal in each end. Sizes NPS 2-1/2 and larger with stainless steel grip ring and EPDM O-ring seal.
2. Minimum 200-psig working-pressure rating at 250 deg F.

D. Copper-Tube, Extruded-Tee Connections:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Apollo Valves; Conbraco Industries, Inc.
   b. Elkhart Products Corporation.
   c. Mueller Industries, Inc.
   d. NIBCO INC.

2. Description: Tee formed in copper tube according to ASTM F 2014.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:
1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:
1. AWWA C110/A21.10, ductile or gray iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:
1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

E. NPS 20 to NPS 46: 150 psig

2.4 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.5 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.6 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.7 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    d. Zurn Plumbing Products Group; Wilkins Water Control Products.

2. Description:

    a. Pressure Rating: 150 psig at 180 deg F.
    b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. EPCO Sales, Inc.
    d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Factory-fabricated, bolted, companion-flange assembly.
    b. Pressure Rating: 150 psig.
    c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Calpico, Inc.
b. Lochinvar Corporation.

2. Description:

a. Galvanized-steel coupling.
b. Pressure Rating: 300 psig at 225 deg F.
c. End Connections: Female threaded.
d. Lining: Inert and noncorrosive, thermoplastic.

F. Dielectric Nipples:
1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F1545.
3. Pressure Rating and Temperature: 300 psig at 225 deg F.
4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install domestic water piping level without pitch and plumb.

G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

J. Install piping adjacent to equipment and specialties to allow service and maintenance.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.

G. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

3.4 DIELECTRIC FITTING INSTALLATION

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2and Smaller: Use dielectric couplings or nipples or unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet If Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

    a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports. Submit for engineer's review and approval.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be one of the following:
   1. Soft copper tube, ASTM B 88, Type K, ASTM B 88 Type L; wrought-copper, solder-joint fittings; and brazed, copper pressure-seal fittings; and pressure-sealed joints.

E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be one of the following:
   1. Soft copper tube, ASTM B 88, Type K, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
   2. Mechanical-joint, ductile-iron pipe; standard-pattern, mechanical-joint fittings; and mechanical joints.

F. Under-building-slab, domestic water distribution piping, NPS 3 and smaller, shall be the following:
   1. Hard copper pipe type L, ASTM B42 or soft copper tube type L, ASTM B 88. wrought-copper, solder-joint fittings; and brazed joints.

G. Aboveground domestic water distribution piping, NPS 2 and smaller, shall be one of the following:
   1. Hard copper tube, ASTM B 88, Type L; copper, solder-joint fittings; and joints.

H. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:

   1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed soldered joints.

I. Aboveground domestic water piping, NPS 5 to NPS 8, shall be one of the following:
   1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed soldered joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

   1. Shutoff Duty: Use ball or gate valves for piping NPS 2and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2and larger.
   2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use ball valves with flanged ends for piping NPS 2-1/2 and larger.
   3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
   4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

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. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Temperature-actuated water mixing valves.
3. Hose bibbs.
4. Wall hydrants.
5. Drain valves.
6. Water hammer arresters.
7. Air vents.
8. Trap-seal primer valves.
9. Trap seal primer systems
10. Flexible connections

B. Related Sections include the following:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Division 22 Section "Domestic Water Piping".

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
3. Comply with NSF 372, “Drinking Water System Components – Lead Content”

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G, NSF 14, and NSF 372.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. FEBCO
b. Zurn Industries, LLC
c. Watts
d. Ames Co.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. FEBCO

b. Zurn Industries, LLC
c. Watts
d. Ames Co.

2.
3. Standard: ASSE 1011.
4. Body: Bronze, nonremovable, with manual drain.
5. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
6. Finish: Chrome or nickel plated.

2.4 BALANCING VALVES

A. Memory-Stop Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Conbraco Industries, Inc.
   b. Crane Co.; Crane Valve Group
   c. Milwaukee Valve Company.
   d. NIBCO INC.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.5 HOSE BIBBS

A. Interior Mechanical Room Application:

1. Available Manufacturers:
   a. Watts.
   b. Nibco.
   c. Chicago.

2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
10. Operation for Equipment Rooms: Wheel handle or operating key.
11. Include operating key with each operating-key hose bibb.

B. Interior Toilet Room Application:

1. Available Manufacturers:

   a. Woodford Manufacturing.
   b. Chicago Faucet.

2. Body: Bronze or brass with integral mounting flange.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish: chrome or nickel plated.
9. Operation: Wheel handle or operating key.
10. Include operating key with each operating-key hose bibb.

2.6 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:
1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4 or NPS 1.
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze or Chrome plated.
9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze in public area, Rough bronze in utility rooms.
11. Operating Keys(s): One with each wall hydrant.

B. Nonfreeze, Hot- and Cold-Water Wall Hydrants:
1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.
5. Inlet: NPS 3/4 or NPS 1.
6. Outlet: Concealed.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze in exposed public area, or Chrome plated.
9. Vacuum Breaker:

   a. Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
   b. Garden-hose thread complying with ASME B1.20.7 on outlet.

10. Operating Key(s): One with each wall hydrant.

C. Vacuum Breaker Wall Hydrants:
1. Standard: ASSE 1019, Type A or Type B.
2. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
3. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
4. Pressure Rating: 125 psig.
5. Operation: Loose key or wheel handle.
6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
7. Inlet: NPS 1/2 or NPS 3/4.
8. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.7 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

D. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.8 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Available Manufacturers:
   a. AMTROL, Inc.
   b. Josam Company.
   c. PPP Inc.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group; Specification Drainage Operation.
   f. Jay R. Smith.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Stainless steel construction with metal bellows, pre-charged.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.9 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.10 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. PPP Inc Model P-2 with Distribution Unit DU-2 or a comparable product by one of the following:

   a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   b. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.11 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:
   1. Standard: ASSE 1044.
   2. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
   3. Cabinet: Recessed-mounted steel box with stainless-steel cover.
   4. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.

      a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

   5. Vacuum Breaker: ASSE 1001.
   6. Number Outlets: Four.
   7. Size Outlets: NPS 1/2.

2.12 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Flex Pression Ltd.
   2. Flex-Hose Co., Inc.
   3. Metraflex Company (The).
   4. Universal Metal Hose.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

   1. Working-Pressure Rating: Minimum 200 psig.
   2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
   3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

   1. Working-Pressure Rating: Minimum 200 psig.
   2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
   3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXCUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install balancing valves in locations where they can easily be adjusted.

C. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.

D. Install Y-pattern strainers for water on supply side of each control valve, solenoid valve, and pump, and where indicated on Drawings.

E. Install water hammer arresters in water piping according to PDI-WH 201.

F. Install air vents at high points of water piping.

G. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

H. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air brakes are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

I. All valves, fittings and specialties shall have a pressure class rating that exceeds the pressure of the system it is installed in.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
4. Double-check, backflow-prevention assemblies.
5. Carbonated-beverage-machine backflow preventers.
6. Dual-check-valve backflow preventers.
7. Reduced-pressure-detector, fire-protection, backflow-preventer assemblies.
8. Double-check, detector-assembly backflow preventers.
9. Water pressure-reducing valves.
10. Calibrated balancing valves.

11. Primary, thermostatic, water mixing valves.
12. Manifold, thermostatic, water mixing-valve assemblies.
13. Photographic-process, thermostatic, water mixing-valve assemblies.
14. Primary water tempering valves.
15. Outlet boxes.
16. Hose stations.
17. Supply-type, trap-seal primer valves.
18. Trap-seal primer systems.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

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. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

B. Related Requirements:

1. Section 221319 "Sanitary Waste piping specialties" for sanitary sewerage piping and structures outside the building.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager, Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Construction Manager's, Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 300-foot head of water
2. Waste, Force-Main Piping: 100 psig.

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ANACO-Husky.
b. Dallas Specialty & Mfg. Co.
c. MIFAB, Inc.
d. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ANACO-Husky.
b. Dallas Specialty & Mfg. Co.
c. MIFAB, Inc.
d. Tyler Pipe.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. ANACO-Husky.
    b. Dallas Specialty & Mfg. Co.
    c. MIFAB, Inc.
    d. Tyler Pipe.

2. Standard: ASTM C 1277.
3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

E. No Hub Fitting Restraints;
1. Basis-of-Design Product: Subject to compliance with requirements, provide Holdrite: 117 Series No Hub Fitting Restraints or comparable.

2. Description: CISPI Designation 301-12, large diameter no-hub cast iron fittings, 4” and over in size, shall be provided with supplemental support to minimize the risk of joints separation under high thrust conditions. Auxiliary restraint products used shall be manufactured assemblies with thrust pressure rating adequate for the specific installation. Field devised methods and materials shall not be used to accomplish this application solution.

2.4 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

A. Pipe: ASTM A 746, for push-on joints.

B. Standard Fittings: AWWA C110/A21.10, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153/A21.53, ductile iron, for push-on joints.

D. Gaskets: AWWA C111/A21.11, rubber.

2.5 DUCTILE-IRON, PRESSURE PIPE AND FITTINGS

A. Mechanical-Joint Piping:

1. Pipe: AWWA C151/A21.51, with bolt holes in bell.
2. Standard Fittings: AWWA C110/A21.10, ductile or gray iron, with bolt holes in bell.
3. Compact Fittings: AWWA C153/A21.53, with bolt holes in bells.
4. Glands: Cast or ductile iron; with bolt holes and high-strength, cast-iron or high-strength, low-alloy steel bolts and nuts.
5. Gaskets: AWWA C111/A21.11, rubber, of shape matching pipe, fittings, and glands

2.6 PRESSURE-TYPE PIPE COUPLINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cascade Waterworks Mfg. Co.
2. Dresser, Inc.

3. Jay R. Smith Mfg. Co.
4. JCM Industries, Inc.
5. Victaulic Company.

B. Tubular-Sleeve Couplings: AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.

C. Metal, bolted, sleeve-type, reducing or transition coupling; for joining underground pressure piping. Include 200-psig minimum pressure rating and ends of same sizes as piping to be joined.

D. Center-Sleeve Material: Stainless steel or Ductile iron.

E. Gasket Material: Natural or synthetic rubber.

F. Metal Component Finish: Corrosion-resistant coating or material

2.7 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.

D. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

E. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

F. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.8 SPECIALTY PIPE FITTINGS

A. Non-pressure Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Non-pressure Transition Couplings:

a. Standard: ASTM C 1173.

b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
c. Sleeve Materials:
1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Concrete Pipes: ASTM C 443, rubber.
3) For Fiberglass Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
4) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
5) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Non-pressure Transition Couplings:

a. Standard: ASTM C 1460.
b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Ring-Type, Flexible Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fernco Inc.
b. Logan Clay Pipe.
c. Mission Rubber Company; a division of MCP Industries, Inc.

2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

C. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

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) Capitol Manufacturing Company.
2) Hart Industries International, Inc.
3) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
4) Wilkins; a Zurn company.

b. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 125 psig minimum at 180 deg F.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Nipples:

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) Grinnell Mechanical Products.
2) Precision Plumbing Products, Inc.
3) Victaulic Company.

b. Description:

1) Electroplated steel nipple complying with ASTM F 1545.
2) Pressure Rating: 300 psig at 225 deg F.
3) End Connections: Male threaded or grooved.
4) Lining: Inert and noncorrosive, propylene.

2.9 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

2.10 EXPANSION JOINTS AND DEFLECTION FITTINGS

A. Ductile-Iron, Flexible Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. EBAA Iron, Inc.
b. Romac Industries, Inc.
c. Star Pipe Products.

2. Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated.

B. Ductile-Iron Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dresser, Inc.
b. EBAA Iron, Inc.
c. JCM Industries, Inc.
d. Smith-Blair, Inc.; a Sensus company.

2. Description: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or

AWWA C153. Include rating for 250-psig minimum working pressure and for expansion indicated.

C. Ductile-Iron Deflection Fittings:

1. Description: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include rating for 250-psigminimum working pressure and for up to 15 degrees of deflection.

2.11 BACKWATER VALVES

A. Cast-Iron Backwater Valves:

1. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg. Co.
b. Josam Company.
c. Watts; a Watts Water Technologies company.
d. Zurn Industries, LLC.

3. Horizontal type; with swing check valve and hub-and-spigot ends.
4. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
5. Terminal type; with bronze seat, swing check valve, and hub inlet.

2.12 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company.
b. Smith, Jay R. Mfg. Co.
c. Watts Water Technologies, Inc.
d. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back-to-back or side by side with common drainpipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

   1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
   2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
   3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

   1. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
   2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

O. Install engineered soil and waste and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.

3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

P. Install underground, ductile-iron, force-main piping according to AWWA C600.

1. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints.
2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
3. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

Q. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

R. Install force mains at elevations indicated.

S. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."

3. Install backwater valves in sanitary waster gravity-flow piping.

a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."

T. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.2 PIPE JOINT CONSTRUCTION

A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

B. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

D. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

E. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

F. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use non-pressure flexible couplings where required to join gravity-flow, non-pressure sewer piping unless otherwise indicated.

    a. Shielded flexible couplings for pipes of same or slightly different OD.
    b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure pipe couplings for force-main joints.

G. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A 674 or AWWA C105/A21.5:
1. Hubless cast-iron soil pipe and fittings.
2. Ductile-iron pipe and fittings.
3. Expansion joints and deflection fittings.

H. Install No Hub Fitting Restraints on all piping 4 inch and over in size, shall be provided with supplemental support to minimize the risk of joints separation under high thrust conditions. Auxiliary restraint products used shall be manufactured assemblies with thrust pressure rating adequate for the specific installation. Field devised methods and materials shall not be used to accomplish this application solution.

3.3 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches Insert dimensions deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Shielded, non-pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples or unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric nipples.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 VALVE INSTALLATION

A. Comply with requirements in Section 220523. General-duty valve installation requirements.

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
4. Vertical Piping: MSS Type 8 or Type 42, clamps.
5. Install individual, straight, horizontal piping runs:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

6. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
7. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting**,** valve, and coupling.

C. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8 : 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

E. Install supports for vertical cast-iron soil piping every 15 feet and or at every floor.

F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
8. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
9. NPS 10 and NPS 12: 12 feet with 7/8-inchrod

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod

H. Install supports for vertical copper tubing every 10 feet and at every floor.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for backwater valves cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
6. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main.
2. Sewage Pump: To sewage pump discharge.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.

    a. Isolate test source and allow to stand for four hours.
    b. Leaks and loss in test pressure constitute defects that must be repaired.

3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.11 PIPING SCHEDULE

A. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy duty hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.
4. Dissimilar Pipe-Material Couplings: Shielded, pressure transition couplings.

B. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Dissimilar Pipe-Material Couplings: Shielded, pressure transition couplings.

C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Copper DWV tube, copper drainage fittings, and soldered joints.

    a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.

5. Dissimilar Pipe-Material Couplings: Shielded, pressure transition couplings.

D. Aboveground, vent piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Dissimilar Pipe-Material Couplings: Shielded, pressure transition couplings.

E. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Extra heavy class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, pressure transition couplings.

F. Underground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Extra heavy class, cast-iron soil piping; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, pressure transition couplings.

G. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.

H. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.

I. Underground sanitary-sewage force mains NPS 4 and smaller shall be any of the following:
1. Ductile-iron, mechanical-joint piping and mechanical joints.
2. Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.

J. Underground sanitary-sewage force mains NPS 5 and larger shall be any of the following:
1. Ductile-iron, mechanical-joint piping and mechanical joints.
2. Pressure transition couplings if dissimilar pipe materials.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:
   1. Backwater valves
   2. Cleanouts.
   3. Air admittance Valves
   4. Roof flashing assemblies.
   5. Through-penetration firestop assemblies.
   6. Miscellaneous sanitary drainage piping specialties.
   7. Flashing Materials
   8. Solids interceptors.

B. Related Sections include the following:

   1. Division 22 Section "Sanitary Waste and Vent Piping".

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. HDPE: High-density polyethylene plastic.

C. PE: Polyethylene plastic.

D. PP: Polypropylene plastic.

E. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:
   1. Grease interceptors.

B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

   1. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing, and marked for intended location and application.

2.2 CLEANOUTS

A. Cast Iron Exposed Cleanouts:

1. Available Manufacturers:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Cast Iron Exposed Floor Cleanouts:

1. Available Manufacturers:

a. Josam Company; Josam Div.
b. Watts Drainage Products Inc.
c. Zurn Plumbing Products Group; Light Commercial Operation.

d. Wade
e. Jay R. Smith.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Threaded.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Medium Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
14. Standard: ASME A112.3.1.
15. Size: Same as connected branch.
16. Housing: Stainless steel.
17. Closure: Stainless steel with seal.
18. Riser: Stainless-steel drainage pipe fitting to clean out.

C. Cast-Iron Wall Cleanouts:
1. Available Manufacturers:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Watts Drainage Products Inc.
d. Zurn Plumbing Products Group; Specification Drainage Operation.
e. Wade
f. Jay R. Smith

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch, or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains:
1. Available manufacturers:
a. Josam Company; Josam Div.
b. Tyler Pipe; Wade Div.
c. Watts Drainage Products Inc.
d. Zurn Plumbing Products Group; Light Commercial Operation.
e. Jay R. Smith

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Anchor Flange: Required.

6. Clamping Device: Required.
7. Sediment Bucket: Not required for finished areas.
8. Top or Strainer Material: Nickel bronze.
9. Top Shape: Round.
10. Top Loading Classification: Light Duty.
11. Trap Material: Cast iron.
12. Trap Pattern: Standard P-trap.

2.4 ROOF FLASHING ASSEMBLIES (all architectural specifications shall supersede this paragraph).

A. Roof Flashing Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Acorn Engineering Company; Elmdor/Stoneman Div.
b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch-thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.
2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.5 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

2.6 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564 rubber gaskets.

2. Size: Same as connected waste piping.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

a. NPS 2: 4-inch-minimum water seal.
b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counter-flashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

H. Frost-Resistant Vent Terminals:

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

I. Expansion Joints:

1. Standard: ASME A112.6.4.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

2.7 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated: (NOT USED)

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft. thickness.
2. Vent Pipe Flashing: 8 oz./sq. ft. thickness.

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backwater valves in building drain piping.

1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

G. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.

H. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

I. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

J. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

K. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

L. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

M. Install air-gap fittings on indirect-waste piping discharge into sanitary drainage system.

N. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

O. Install vent caps on each vent pipe passing through roof.

P. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

Q. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

R. Install wood-blocking reinforcement for wall-mounting-type specialties.

S. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

T. All valves, fittings and specialties shall have a pressure class rating that exceeds the pressure of the system it is installed in.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Intercepters.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 PROTECTION

A. Protect drains during the remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 221319.13 - SANITARY DRAINS

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. Cast iron floor drains.
   2. Stainless steel floor drains
   3. Cast iron floor sinks
   4. Stainless steel floor sinks
   5. Trench drains.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene styrene.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene.

D. PE: Polyethylene.

E. PP: Polypropylene.

F. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary piping specialty components.

C. All sanitary floor drains shall be provided with pro-vent trap guard size for each floor drain. Product shall be tested in accordance with ASSE 1072 test standard for ANSI/ASME A112.6.3

D. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg. Co.
    b. Josam Company.
    c. Watts; a Watts Water Technologies company.
    d. Zurn Industries, LLC.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom or Side coordinate with filed conditions.
9. Backwater Valve: Not required unless indicated on drawings.
10. Coating on Interior and Exposed Exterior Surfaces: For laboratory applications Acid-resistant enamel.
11. Sediment Bucket:
12. Top or Strainer Material: Gray cast iron in mechanical equipment rooms, polished nickel bronze in all finished areas.
13. Top Shape: Round or Square as scheduled.
14. Dimensions of Top or Strainer: Refer to schedule.
15. Top Loading Classification: Heavy Duty 20 for any application subject to traffic like parking or repair garages.
16. Funnel: Not required unless specified on plan or in schedule.
17. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
18. Trap Material: Cast iron.
19. Trap Pattern: Standard P-trap.
20. Trap Features: Cleanout, Trap-seal primer valve drain connection where indicated in schedule.

E. Stainless-Steel Floor Drains, ASME A112.3.1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Jay R. Smith Mfg. Co.
    b. Josam Company.
    c. Watts; a Watts Water Technologies company.
    d. Zurn Industries, LLC.

2. Outlet: Bottom or Side.

3. Top or Strainer Material: Stainless steel.
4. Top Shape: Round or Square.
5. Dimensions of Top or Strainer:
6. Seepage Flange: Required.
7. Anchor Flange: Required.
8. Clamping Device: Required.
9. Trap-Primer Connection: Required where indicated on plan
10. Trap Material: Stainless steel.
11. Trap Pattern: Standard P-trap.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.

    a. Maintain integrity of waterproof membranes where penetrated.

5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

B. Install trench drains at low points of surface areas to be drained.

1. Set grates of drains flush with finished surface, unless otherwise indicated.

C. Comply with ASME A112.3.1 for installation of stainless-steel channel drainage systems.

1. Install on support devices, so that top will be flush with adjacent surface.

D. Install FRP channel drainage system components on support devices, so that top will be flush with adjacent surface.

E. Install plastic channel drainage system components on support devices, so that top will be flush with adjacent surface.

F. Install open drain fittings with top of hub 2 inches above floor.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.

C. Comply with requirements in Section 221323 "Sanitary Waste Interceptors" for grease interceptors, grease-removal devices, oil interceptors, sand interceptors, and solid interceptors.

D. Install piping adjacent to equipment to allow service and maintenance.

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Hubless, cast-iron soil pipe and fittings.
   2. Specialty pipe and fittings.
   3. Encasement for underground metal piping.
   4. Division 33 Section "Storm Utility Drainage Piping" for storm drainage piping outside the building.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

   1. Storm Drainage Piping: 10-foot head of water.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For controlled-flow roof drainage system. Include calculations, plans, and details.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager, Owner no fewer than two days in advance of proposed interruption of storm-drainage service.
2. Do not proceed with interruption of storm-drainage service without Construction Manager's, Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 300-foot head of water
2. Storm Drainage, Force-Main Piping: 100 psig.

2.2 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUBLESS, CAST-IRON PIPE AND FITTINGS

A. Pipe and Fittings:

1. Marked with CISPI collective trademark and NSF certification mark.
2. Standard: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Fernco Inc.
   b. MIFAB, Inc.
   c. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Fernco
   b. ANACO-Husky.
   c. MIFAB, Inc.
   d. Tyler Pipe; a subsidiary of McWane Inc.

2. Standard: ASTM C 1540.

3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. No Hub Fitting Restraints;

1. Basis-of-Design Product: Subject to compliance with requirements, provide Holdrite: 117 Series No Hub Fitting Restraints or comparable
2. Description: CISPI Designation 301-12 , large diameter no-hub cast iron fittings, 4" and over in size, shall be provided with supplemental support to minimize the risk of joints separation under high thrust conditions. Auxiliary restraint products used shall be manufactured assemblies with thrust pressure rating adequate for the specific installation. Field devised methods and materials shall not be used to accomplish this application solution.

2.4 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
3. Unshielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Dallas Specialty & Mfg. Co.
2) Fernco Inc.
3) Mission Rubber Company, LLC; a division of MCP Industries.
4) Plastic Oddities.

b. Standard: ASTM C 1173.

c. Description: Elastomeric sleeve, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

d. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

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) Cascade Waterworks Mfg. Co.
2) Mission Rubber Company, LLC; a division of MCP Industries.

b. Standard: ASTM C 1460.

c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.

5. Pressure Transition Couplings:

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) Cascade Waterworks Mfg. Co.
2) EBAA Iron, Inc.
3) Ford Meter Box Company, Inc. (The).
4) JCM Industries, Inc.
5) Romac Industries, Inc.

b. Standard: AWWA C219.

c. Description: Metal, sleeve-type couplings same size as pipes to be joined, and with pressure rating at least equal to and ends compatible with pipes to be joined.
d. Center-Sleeve Material: Carbon steel, Stainless steel, Ductile iron.
e. Gasket Material: Natural or synthetic rubber.
f. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

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) Capitol Manufacturing Company.
2) Central Plastics Company.
3) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
4) Wilkins; a Zurn company.

b. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 150 psig at 180 deg F.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

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) Capitol Manufacturing Company.
2) Central Plastics Company.

3) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
4) Wilkins; a Zurn company.

b. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: 150 psig.
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:

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) Advance Products & Systems, Inc.
2) Calpico, Inc.
3) Central Plastics Company.
4) Pipeline Seal and Insulator, Inc.

b. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig.
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel-backing washers.

5. Dielectric Nipples:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Grinnell Mechanical Products.
2) Matco-Norca.
3) Precision Plumbing Products.

b. Description: Electroplated steel nipple.
c. Standard: IAPMO PS 66.
d. Pressure Rating: 300at 225 deg F.
e. End Connections: Male threaded or grooved.
f. Lining: Inert and noncorrosive, propylene.

2.5 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: High-density, cross-laminated polyethylene film of 0.004-inchor linear low-density polyethylene film of 0.008-inchminimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

2.6 CLEANOUTS

A. Cast-Iron Exposed Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. Wade; a subsidiary of McWane Inc.
    d. WATTS.
    e. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: No hub or Hub with gasket.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy or Polished bronze, Rough bronze for unfinished areas.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Extra-Heavy Duty.
13. Riser: ASTM A74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

B. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. WATTS.
    d. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch No-hub, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug:

    a. Brass.
    b. Countersunk or raised head.
    c. Drilled and threaded for cover attachment screw.
    d. Size: Same as, or not more than, one size smaller than cleanout size.

6. Wall Access, Cover Plate: Round, deep, chrome-plated bronze flat, or chrome-plated brass or stainless steel cover plate with screw.
7. Wall Access, Frame and Cover: Round, or Square, nickel-bronze, copper-alloy, or stainless steel or aluminum wall-installation frame and cover.

2.7 Test Tees:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Josam Company.
    b. Smith, Jay R. Mfg. Co.
    c. Watts Water Technologies, Inc.
    d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
3. Size: Same as connected drainage piping.
4. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
5. Closure Plug: Countersunk, brass.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.

B. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

C. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install piping to allow application of insulation.

I. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Lay buried building piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.

2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

K. Install storm drainage piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4and larger.
2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

L. Install cast-iron storm piping according to CISPI's "Cast Iron Storm Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron storm Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

M. Install engineered controlled-flow drain specialties and storm drainage piping in locations indicated.

N. Install steel piping according to applicable plumbing code.

O. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

P. Install underground, ductile-iron, force-main piping according to AWWA C600.

1. Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints.
2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
3. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

Q. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

R. Install force mains at elevations indicated.

S. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Storm Drainage Piping Specialties."
2. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Storm Drainage Piping Specialties."

T. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

V. Insall sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

E. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

F. Joint Restraints and Sway Bracing:

1. Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:

a. Provide axial restraint for pipe and fittings 5 inchesand larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.
b. Provide rigid sway bracing for pipe and fittings 4 inchesand larger, upstream and downstream of all changes in direction 45 degrees and greater.
c. Provide rigid sway bracing for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction and branch openings.

G. All no-hub cast iron fittings, 4” and over in size, shall be provided with supplemental support to minimize the risk of joints separation under high thrust conditions. Auxiliary restraint products used shall be manufactured assemblies with thrust pressure rating adequate for the specific installation. Field devised methods and materials shall not be used to accomplish this application solution

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples or unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges, flange kits, nipples.
4. Dielectric Fittings for NPS 5and Larger: Use dielectric flange kits.

3.4 VALVE INSTALLATION

A. General valve installation requirements for general-duty valve installations are specified in the following Sections:

1. Section 220523 general duty valves for plumbing."

B. Shutoff Valves:

1. Install shutoff valve on each sump pump discharge.
2. Install full port ball valve for piping NS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2and larger.

C. Check Valves: Install swing-check valve, between pump and shutoff valve, on each sump pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Install backwater valves in accessible locations.
3. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
4. Vertical Piping: MSS Type 8 or Type 42, clamps.
5. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet:MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

6. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
7. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inchminimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.

F. Install supports for vertical cast-iron soil piping every 15 feet and at every floor

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
8. NPS 10 and NPS 12: 12 feet with 7/8-inch rod.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

J. Install supports for vertical copper tubing every 10 feet.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.

2. Comply with requirements for cleanouts specified in Division 22 Section "Storm Drainage Piping Specialties."

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.

    a. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

F. Piping will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground storm drainage piping NPS 6 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; Heavy Duty, hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Copper Type DWV tube, copper drainage fittings, and soldered joints.
5. Dissimilar Pipe-Material Couplings: Shielded, pressure transition couplings.

C. Aboveground, storm drainage piping NPS 8 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy duty, hubless-piping couplings; and coupled joints.

3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Copper Type DWV tube, copper drainage fittings, and soldered joints.
5. Dissimilar Pipe-Material Couplings: Shielded, pressure transition couplings.

D. Underground storm drainage piping NPS 6 and smaller shall be any of the following:

1. Extra heavy class, cast-iron soil pipe and fittings; gaskets; heavy-duty, hubless-piping couplings; and coupled joints.

2. Dissimilar Pipe-Material Couplings: Shielded, pressure transition couplings.

E. Underground, storm drainage piping NPS 8 and larger shall be any of the following:

1. Extra heavy class, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.

2. Dissimilar Pipe-Material Couplings: Shielded, pressure transition couplings.

END OF SECTION

SECTION 22 14 23 STORM DRAINAGE PIPING SPECIALTIES

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. Roof drains.
2. Miscellaneous storm drainage piping specialties
3. Cleanouts.
4. Backwater valves.
5. Trench drains.
6. Channel drainage systems.
7. Through-penetration firestop assemblies.
8. Flashing materials.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

A. Cast-Iron, General-Purpose Roof Drains:

1. IRMA Roof Applications: Jay R. Smith Model 1011:
   Insulated Deck: Jay R. Smith Model 1015
   Concrete Deck: Jay R. Smith Model 1010
   Side Outlet: Jay R. Smith Model 1020
   Side Outlet Overflow Drain: Jay R. Smith Model 1070-SO

   a. Josam Company.
   b. MIFAB, Inc.
   c. Watts Water Technologies, Inc.
   d. Zurn Plumbing Products Group; Light Commercial Products Operation.

2. Standard: ASME A112.6.4, for general-purpose roof drains.

3. Body Material: Cast iron.
4. Dimension of Body;
   a. Small Sump 8”
   b. Medium Sump 8” -12”
   c. Large Sump 14”-16”
5. Combination Flashing Ring and Gravel Stop: Required.
6. Flow control weir; required
7. Outlet: Bottom or Side. Coordinate in field
8. Outlet Type: No hub threaded
9. Extension Collars: Required.
10. Underdeck Clamp: Required.
11. Expansion Joint: Required.
12. Sump Receiver Plate: Required.
13. Dome Material: Cast iron.
14. Wire Mesh: Stainless steel or brass over dome.
15. Perforated Gravel Guard: Stainless steel.
16. Vandal-Proof Dome: Required.
17. Water Dam: Not required.

2.2 CLEANOUTS

A. Floor Cleanouts :

1. Jay R. Smith Model 4253:

   a. Josam Company.
   b. Watts Water Technologies, Inc.
   c. Zurn Plumbing Products Group; Light Commercial Products Operation.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected branch.
4. Type: Cast-iron soil pipe with cast-iron ferrule or Threaded, adjustable housing.
5. Body or Ferrule Material: Cast iron.
6. Clamping Device: Required.
7. Closure: Brass plug with tapered threads.
8. Frame and Cover Material and Finish: Nickel-bronze, copper alloy, Polished bronze.
9. Frame and Cover Shape: Round.
10. Top-Loading Classification: Light Duty.
11. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

B. Test Tees:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Josam Company.
   b. Smith, Jay R. Mfg. Co.
   c. Watts Water Technologies, Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
3. Size: Same as connected drainage piping.

4. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
5. Closure Plug: Countersunk, brass.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

C. Wall Cleanouts:

1. Jay R. Smith Model 4472:

   a. Josam Company.
   b. Watts Water Technologies, Inc.
   c. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
3. Size: Same as connected drainage piping.
4. Body Material: Hubless as required to match connected piping.
5. Closure: Countersunk or raised-head, drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.3 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. ProSet Systems Inc.

2. Standard: ASTM E 814, for through-penetration firestop assemblies.
3. Certification and Listing: Intertek Testing Service NA for through-penetration firestop assemblies.
4. Size: Same as connected pipe.
5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
6. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
7. Special Coating: Corrosion resistant on interior of fittings.

2.4 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft..

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07 Sections.

1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Position roof drains for easy access and maintenance.

B. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:

1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate cleanouts at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install test tees in vertical conductors and near floor.

F. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

G. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.

H. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

I. Install through-penetration firestop assemblies for penetrations of fire- and smoke-rated assemblies.

1. Comply with requirements in Section 078413 "Penetration Firestopping."

J. All valves, fittings and specialties shall have a pressure class rating that exceeds the pressure of the system it is installed in.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Submersible sump pumps.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
4. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with manufacturer's written instructions for handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

2.2 SUBMERSIBLE SUMP PUMPS

A. Submersible, Fixed-Position, Double-Seal Sump Pumps: Product indicated on drawings:
   1. Description: Factory-assembled and -tested sump-pump unit.
   2. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
   3. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
   4. Impeller: Statically and dynamically balanced, ASTM A48/A48M, Class No. 25 A cast iron and ASTM B584, cast bronze, semiopen design for clear wastewater handling, and keyed and secured to shaft.
   5. Pump and Motor Shaft: Stainless steel or steel, with factory-sealed, grease-lubricated ball bearings.
   6. Seals: Mechanical.
   7. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.
   8. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

      a. Motor Housing Fluid: Air.

   9. Controls:

      a. Enclosure: NEMA 250, Type 1.
      b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
      c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
      d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.
      e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120 V ac, with transformer and contacts for remote alarm bell.

   10. Control-Interface Features:

      a. Remote Alarm Contacts: For remote alarm interface.
      b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

         1) On-off status of pump.
         2) Alarm status.

2.3 SUMP-PUMP CAPACITIES AND CHARACTERISTICS

A. As indicated on drawings.

2.4 SUMP-PUMP BASINS AND BASIN COVERS

A. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections.

1. Material: Fiberglass.
2. Reinforcement: Mounting plates for pumps, fittings, and accessories.
3. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.

B. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.

1. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.

2.5 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation and filling are specified in Section 312000 "Earth Moving."

3.2 EXAMINATION

A. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

3.3 INSTALLATION

A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

3.4 CONNECTIONS

A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to equipment, allow space for service and maintenance.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test, inspect, and adjust components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Pumps and controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust control set points.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Wall-mounted water closets. - Back outlet.
2. Flushometer valves.
3. Toilet seats.
4. Supports.

B. Related Requirements:

1. Section 221316 "Sanitary waste and vent piping”
2. Section 221319 "Sanitary Waste and Vent Piping specialties.”

1.3 DEFINITIONS

A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

B. Remote Water Closet: Located more than 30 feet from other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

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 for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED WATER CLOSETS

A. Water Closets, Floor Mounted, Top Spud, Accessible P-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Standard.
    b. Crane Plumbing, L.L.C.
    c. Kohler Co.
    d. Sloan Valve Company.
    e. Zurn Industries, LLC.

2. Bowl:

    a. Basis of Design: American Standard 3461.001 Madera Flowise with Everclean.
    b. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
    c. Material: Vitreous china.
    d. Type: Siphon jet.
    e. Style: Flushometer valve.
    f. Height: Standard.
    g. Rim Contour: Elongated.
    h. Water Consumption: 1.28 gal. per flush.
    i. Spud Size and Location: NPS 1-1/2; top.

3. Flushometer Valve: Sloan Royal 111 manual flush valve, ADA compliant
4. Toilet Seat: Split front – elongated.
5. Water-Closet Mounting Height: As indicated on architectural plans.

B. Flush Valve:
1. Flushometer Valve: Sloan Royal 111-1.28, ADA compliant
2. Manual operation.
3. Adjustable Sanitary Flush cleans the fixture & maintains the trap seal.
4. Chemical Resistant EPDM Seals for extended life
5. Adjustable Tailpiece for rough-in flexibility
6. Can be installed left or right-handed – coordinate in field

2.2 TOILET SEATS

A. Toilet Seats P-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Standard.
    b. Church Seats; Bemis Manufacturing Company.
    c. Kohler Co.
    d. Zurn Industries, LLC.

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial heavy duty
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.
5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.

2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 224213.16 - COMMERCIAL URINALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Wall-hung urinals.
   2. Urinal flushometer valves.
   3. Supports.

1.3 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 urinals.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

   1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.
   2. Waterless Urinal Trap-Seal Cartridges: Equal to 200 percent of amount of each type installed, but no fewer than 12 of each type.
   3. Waterless Urinal Trap-Seal Liquid: Equal to 1 gal. for each urinal installed.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS (P-2)

A. Urinals, Square Wall Hung, Back Outlet, Washout

B. Basis of design: American Standard 6590.001 Washbrook, Flowise High efficiency Urinal model with Sloan Flush valve model 186-0.125-CP.

C. Manufacturers: Subject to compliance with project requirements, and review and approval by the Engineer provide a comparable product by one of the following:

a. American Standard.
b. Kohler Co.
c. Zurn Industries, LLC.

1. Fixture:
   a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
   b. Material: Vitreous china.
   c. Type: Washout
   d. Strainer or Trapway: with integral trap.
   e. Water Consumption: 0.125 gpf
   f. Inlet spud Size and Location: NPS 3/4, top.
   g. Outlet Size and Location: NPS 2, back.
   h. Flushing rim
   i. Washout flush action
   j. Meets ASME flush requirements at 0.125 to 1.0 gpf
   k. Color: White.
   l. Mounting height up to 24”. 17” where ADA required.

2. Flushometer Valve: Sloan Royal 186-0.125-CP
   a. Adjustable tailpiece
   b. Chemical resistant EPDM seals are unaffected by chloramines and ammonia.
   c. Sanitary Flush - Valve automatically flushes after 24 hours of non-use to clean fixture & maintain trap seal.
   d. No external volume adjustment.
   e. 5 second Arming Delay prevents unintentional flushing.
   f. 3-second Flush Delay.
   g. Can be installed left or right-handed.
   h. Operating pressure: 20 psi (flowing) – 80 psi (static)

3. Waste Fitting:
   a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
   b. Size: NPS 3.

4. Support: Zurn model Z1221 Wall urinal support system with top support plate. Complete with Dura-Coated rectangular steel uprights with welded feet, adjustable support plate, and mounting fasteners.

5. Urinal Mounting Height: Standard and Handicapped/elderly according to ICC A117.1. refer to architectural plans for locations and heights.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.

B. Examine walls and floors for suitable conditions where urinals will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Urinal Installation:

1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
4. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.
5. Install trap-seal liquid in waterless urinals.

B. Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use carriers without waste fitting for urinals with tubular waste piping.
4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.

3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed urinals and fittings.

C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.16

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. Vitreous China Lavatories.
2. Faucets.
3. Supply fittings.
4. Waste fittings.
5. Supports.

1.3 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 lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of automatic faucets.

1.6 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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory - Rectangular, Vitreous China, Wall Mounted, with Back (P-3):
1. Fixture:

a. Basis of Design: American Standard 0321.075 Declyn Wall Mount
b. Standard: ASME A112.19.2/CSA B45.1.
c. Type: For wall hanging.
d. Nominal Size: Rectangular, 18 by 17.5 inches.
e. Faucet-Hole Punching: Three holes, 4-inch centers.
f. Faucet-Hole Location: Top.
g. Color: White.
h. Mounting Material: Chair carrier.

2. Faucet: P-3
3. Support: Type II, concealed-arm lavatory carrier.
4. Lavatory Mounting Height: Standard.

2.2 SOLID-BRASS, MANUALLY OPERATED LAVATORY FAUCETS (P-3)

A. NSF Standard: Comply with NSF 372 for faucet materials that will be in contact with potable water.

B. Lavatory Faucets (P-3): Two-Handle, metering, mixing, solid-brass valve.
1. Basis of Design Manufacturer/Model: Moen 8886
2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
4. Body Type: Two hole.
5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 0.5 gpm.
8. Mounting Type: Deck, concealed.
9. Drain: Not part of faucet.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle.

F. Risers:

1. NPS 1/2.
2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

2.4 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/4.
2. Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.

2.5 SUPPORTS

A. Type II Lavatory Carrier:

1. Standard: ASME A112.6.1M.

B. Type III Lavatory Carrier:

1. Standard: ASME A112.6.1M.

2.6 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Engineered Brass Co.
   b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
   c. McGuire Manufacturing Co., Inc.
   d. Plumberex Specialty Products Inc.
   e. TCI Products.
   f. TRUEBRO, Inc.
   g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. TRUEBRO, Inc.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Drinking fountains.
2. Bottle filling stations.
3. Supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of drinking fountain and bottle filling station.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include operating characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include diagrams for power wiring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For drinking fountains and bottle filling stations to include in maintenance manuals.

1.5 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. Filter Cartridges: Equal to 5 percent of quantity installed for each type and size indicated, but no fewer than 2 of each.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Drinking fountains and bottle filling stations intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 or NSF 372, or be certified in compliance with NSF 61 or NSF 372 by an ANSI-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
2. Comply with ASME A112.19.3/CSA B45.4 for stainless steel drinking fountains and bottle filling stations.
3. Comply with NSF 42 and NSF 53 for water filters for drinking fountains and bottle filling stations.
4. Comply with ICC A117.1 for accessible drinking fountains and bottle filling stations.

2.2 BOTTLE FILLING STATIONS

A. Bottle Filling Station - Surface Wall-Mounted, Stainless Steel: P-4.
   1. Basis of Design: Elkay LZ8WSSMC
   2. Source Limitations: Obtain surface wall-mounted, stainless steel, bottle filling stations from single source from single manufacturer.
   3. Type: Vandal resistant.
   4. Cabinet: Stainless steel.
   5. Bottle Filler: Sensor activation, with 20-second automatic shutoff timer. Fill rate 0.5 to 1.5 gpm.
   6. Drain: Grid type with NPS 1-1/4 tailpiece.
   7. Supply: NPS 3/8 with shutoff valve.
   8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
   9. Filter: One or more water filters complying with NSF 42 and NSF 53 and with capacity sized for peak flow rate.
   10. Support: Provide manufacturer’s mounting plate and drinking fountain carrier.
   11. Bottle Filling Station Mounting Height: As indicated on architectural drawings.
   12. Electrical Characteristics: As indicated on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set pedestal drinking fountains and bottle filling stations on flat surface in accordance with manufacturer's written installation instructions.

C. Install recessed, drinking fountains and bottle filling stations secured to wood blocking in wall construction.

D. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523 General-Duty Valves for Plumbing Piping."

F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball or gate shutoff valve on water supply to each fixture. Install valve upstream from filter for drinking fountain. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523 General-Duty Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ELECTRICAL CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

C. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplates to be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplates to be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.5 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

3.6 CLEANING

A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These basic Mechanical Requirements apply to all Division 23 Sections.

B. The work of this Section consists of providing of all materials, labor and equipment and the like necessary and/or required for the complete execution of all HVAC and related work for this project, as required by the contract documents.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER RESPECTIVE SECTIONS OF THIS DIVISION

A. Motor starters shall be furnished under this Division. Refer to Specification Section 230513 Common motor requirements for HVAC equipment" for technical information.

1.4 REFERENCES

A. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers Guides and Standards, latest editions.

B. SMACNA - Sheet Metal and Air Conditioning Contractors National Association.

C. ASME - American Society of Mechanical Engineers.

D. UL - Underwriters Laboratory.

E. NFPA - National Fire Protection Association.

1.5 REGULATORY REQUIREMENTS

A. Conform to New York State Building Codes and Energy Code as well as all local codes.

B. Plumbing: Conform to New York State Plumbing Code.

C. Obtain permits, and request inspections from authority having jurisdiction.

D. NY State Education Department Facility Guidelines

1.6 QUALITY ASSURANCE

A. The Contractor shall have the work indicated on the drawings and/or specified in each section performed by vendors or mechanics experienced and skilled in its implantation or by a “Specialist”, “Specialty Contractor” or “Specialty Subcontractor” under contractual agreement with the Contractor. These terms mean an individual or firm of established reputation, or, if newly organized, whose personnel have previously established a reputation in the same field, which is regularly engaged in, and which maintains a regular force of workmen skilled in either manufacturing or fabricating items required by the Contract, installing items required by the Contract, or otherwise performing work required by the Contract.

B. Where the Contract Specifications require installation by a "Specialist," that term shall also be deemed to mean either the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform such work under the manufacturer's direct supervision.

1.7 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed arrangement of Work to meet Project conditions, including changes to Work specified in other Sections.

1.8 SCOPE OF WORK

A. This Contractor shall be responsible for coordinating his work with all other trades.

B. The Contractor shall provide all materials, labor, equipment, tools, appliances, services, hoisting, scaffolding, supervision and overhead for the furnishing and installing of all mechanical work and related work including but not limited to the following:

1. Packaged roof top AC units, curbs and specialties.
2. DX split systems
3. VRF AC systems
4. Hot water coils.
5. Fans
6. Equipment and BMS Controls
7. Hydronic piping, valves, fittings, and specialties.
8. Ductwork and specialties.
9. Pipe and duct insulation.
10. Equipment Supports
11. Automatic temperature controls.
12. Grilles, registers, louvers, and diffusers.
13. Vibration isolation.
14. Motor starters and disconnects.
15. Protection.
16. Identification.
17. Coordination.
18. Phasing.
19. Rigging.
20. Testing and Balancing Reports Air and Water.
21. Shop Drawings.
22. As-Built Drawings and Maintenance Manuals.

23. Warrantees.
24. Commissioning

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Construct all apparatus of materials and pressure ratings suitable for the conditions encountered during continuous operation.

B. Construct all equipment in accordance with the requirements of all applicable codes. All pressure vessels and safety devices that fall within the scope of the ASME Code shall conform to the Code and bear the ASME label or stamp.

C. Match and balance all system components to achieve compatibility of equipment or satisfactory operation and performance throughout the entire operating temperature and control ranges. All installations shall be in accordance with the manufacturer's recommendations.

D. Provide all controls, wiring, piping, valves, accessories, and other components necessary to make all systems complete and operable.

E. The contractor shall warranty all work, including labor and materials, and equipment furnished and installed as part of this contract for a minimum period of year from the date of acceptance by the owner, in writing. Certain equipment, such as underground fuel tanks, may have longer warranties as indicated in the specifications. In such cases the longer of the two warranties shall prevail.

3.2 SHOP DRAWINGS AND SUBMITTALS (COORDINATE WITH DIVISION 1)

A. Shop drawings and samples shall be prepared and submitted in accordance with the requirements established in the contract and shall consist of all the items listed in the following paragraphs.

B. Manufacturer's data or shop drawings giving full information as to dimensions, materials, and all information pertinent to the adequacy of the submitted equipment shall be submitted for review. Shop drawings shall include, but not be limited to the following:

C. Submit all Mechanical equipment noted and scheduled on plans including but not limited to the following:
1. Automatic Temperature Controls, Operation Sequences & Wiring Diagrams, and Control Diagrams hardware and software
2. Motor Starters and Controllers
3. Hot water, and piping, valves and specialties
4. Packaged and split roof top air condoning units and curbs
5. Split Air Handling Units
6. Energy recovery units
7. Vibration isolation
8. Hangers and Inserts
9. Equipment Supports and Vibration Eliminators

10. Sheet Metal Construction Standards
11. Piping Layout (1/4 scale)
12. Ductwork Layout (1/4 scale)
13. Insulation (piping and ductwork)
14. Piping, Valves, fittings, and Specialties
15. Fin Tube Radiators
16. Unit Heaters
17. Filters
18. Fan Curves and Sound Rating
19. Coils
20. Fuel Oil Day Tank, Pumps, and accessories
21. Fuel Oil Piping, Valves, and specialties
22. Fire dampers, Motorized Dampers, Smoke dampers
23. Diffusers Registers and Grilles
24. Balancing Reports, Air and Water
25. Coordinated Composite Drawings on Mylar with Piping, Ductwork, Conduits, Lights, registers Grilles and Smoke Detectors, etc.

D. The contractor shall, upon award, submit a schedule for the engineer's review indicating when each of the above shop drawings shall be submitted. Submittals shall be made in a timely manner as the project progresses in accordance with the Construction manager or General contractor's work schedules. The contractor shall allow sufficient time for the engineers to perform his review. A minimum of 10 business days shall be required. Untimely submittals shall be cause for the owner to make a delay against the contractor.

E. Demolition, purchase and or installation shall not begin until shop drawings pertaining to the equipment associated with any related potion of the work have been submitted.

F. Sheet metal shop drawings shall indicate all existing and/or new lights, walls, piping, structural elements, existing work, etc. and dimension locations of ductwork including elevations in relation to these items.

G. Where shop drawings have been reviewed by the Engineer, such review shall not be considered as a guarantee of measurements or building conditions. Where drawings have been reviewed, said review does not mean that drawings have been checked in detail; said review does not substantiate any quantities and in any way relieve the Contractor from his responsibility nor the necessity of furnishing materials or performing work required by the Contract Drawings and Specifications. It does not relieve the contractor of the responsibility to perform all work to accepted industry standards and in a code compliant manor. Approval of shop drawings containing errors does not relieve the contractor from making corrections at his expense.

H. Where substitutions are submitted for approval, the review shall be for general performance comparison to the specified product. Products shall not be reviewed for size, clearance or coordination with other trades. Coordination with other trades shall be the responsibility of the contractor. And changes to existing conditions or changes required to the work of other trades such as a result of substituted material or equipment approved or not shall be the responsibility of this contractor.

I. Approval of shop drawings

1. The Contractor shall be specifically responsible for checking equipment dimensions and clearances and confirming that equipment will fit into the designated space and connect properly to adjoining equipment and/or materials.

2. Submittals marked "Make Corrections Noted" give authority to proceed in accordance with the notes. However, if drawings are also marked "Amend and Resubmit", corrected drawings must be resubmitted for final review.

3. Submittals marked "Rejected" do not give authority to proceed with any portion of the work shown there-on. Drawings must be resubmitted.

4. Submittals marked "Rejected" or "Amend and Resubmit" shall include a specific written response to the engineer’s comments. Resubmission of a submittal without a written response to the engineer’s comments will be considered incomplete and shall be returned un-reviewed.

3.3 CHARTS AND TAGS

A. The Contractor shall provide three sets of charts and diagrams of all piping systems indicating the number and location of valves, controls, etc.

B. All valves, dampers, and controls shall be designated with brass tags. Refer to section 23 05 23 Identification for HVAC Piping and equipment.

C. GENERAL AND SUPPLEMENTARY CONDITIONS and Division 01 Specification Sections, apply to this Section.

3.4 FEES & PERMITS

A. The Contractor shall obtain all permits and pay all fees required related to this scope of work.

3.5 PAINTING

A. All motors, fans and all other factory manufactured and assembled apparatus shall be factory coated with one coat of primer and one coat of machinery enamel standard color at the factory and after installation, all finishes shall be cleaned and touched up to repair any damage incurred during construction.

B. All piping shall be painted in colors conforming with OSHA Standards. All new and existing exposed iron and supplementary dunnage steel shall be finished according to specifications.

C. All supports, nuts, bolts and hanger fasteners located outside shall be galvanized or nickel plated.

3.6 RIGGING

A. Furnish all labor, materials and equipment required to rig equipment and materials.

B. The rigger shall secure any necessary permits and comply with all applicable Federal, State and local safety regulations. A copy of permits to be kept at both the project site and Engineer's Office.

C. The rigger shall have a minimum of five (5) years of practical experience and hold a master riggers license if required.

D. The procedure for rigging shall be submitted to the Engineer for review. All possible precautions should be taken to prevent damage to the structure, streets, sidewalks, curbs, lawns, etc.

3.7 CUTTING AND PATCHING

A. All cutting and patching required for piping, ductwork, control conduits, etc., passing through walls, floors, and roof shall be provided by this Contractor under this contract unless otherwise noted. This Contractor shall be responsible for any damage done to the structure due to his negligence.

B. Patching materials and application shall match existing construction.

C. Where applicable, new holes for piping installation shall be core drilled.

D. Pipe Sleeves & Fire-stopping:

1. Provide for all pipes, conduits ducts, and other elements passing through floors, walls, partitions and structural elements, sleeves as specified. Sleeves shall be of adequate diameter to allow for a minimum of 3/4 inches clear all around sleeve and pipe. When pipe, conduit ducts or other such element penetrates other than fire rated assembly and is insulated, insulation shall pass continuously through sleeves with 1/2-inch clearance between insulation and sleeve.
2. Where pipes, conduits and other such elements penetrate fire rated assemblies, or where holes or voids are created to extend mechanical systems through fire rated assemblies (walls, floors, ceilings, structure, etc.); sleeves and fire-stopping systems shall be installed.

E. Furnish access doors, to the General Contractor for installation where required in finished walls, partitions and the like for access to junction boxes, controls, valves, etc, concealed behind finished construction.

F. Submit location drawings and sizes for review prior to installation.

3.8 PROTECTION-COORDINATE WITH DIVISION 1

A. Special protection is required for installation of a Derrick or other device for rigging purposes. This Contractor shall coordinate with the rigger to facilitate rigging work.

B. B. Recommendations and Provisions of ANSI Bulletin A10.2 and OSHA shall be complied with in-so-far as applicable to the work.

C. The Contractor shall provide temporary partitions or tarpaulins to protect adjacent spaces and/or equipment. He shall be responsible for any damage or injury to person or property of any character resulting from any act, omission, neglect or misconduct in his manner or method of executing his work.

D. The Contractor shall restore at his own expense such property to a condition similar or equal to that existing before such damage or injury in an acceptable manner.

E. The Contractor, furthermore, shall conduct his operations in such a manner as to prevent dust and debris from transferring onto adjoining property or into existing spaces.

F. All openings cut in walls, floors, roof or ceilings of the building, for conduit, pipe, ductwork, etc., shall be closed off with box-type temporary protective enclosures of ¼" tempered hardboard, except when mechanics are actually working at the particular opening. Enclosures shall be constructed of fireproof 2x4 frame, four (4) sides covered and made completely dust and watertight.

G. All finished floor areas through which the contractor must pass with materials or equipment shall be protected with a layer of ¼" hardboard, "Masonite", laid with joints taped together.

3.9 EQUIPMENT SUPPORTS

A. A. Provide supplementary steel dunnage, curbs, angle iron stands, etc., to properly set and install all equipment, including supports necessary to properly pitch piping.

3.10 WELDING

A. A. Welding and equipment shall conform to the American Welding Society's Code for Welding in Building Construction, latest edition as well as state and local laws and ordinances.

B. The handling and storage of all welding materials, acetylene and oxygen tanks, burners, and other equipment required for the execution of welding and cutting work shall be subject at all times to the approval of the Owner and/or Architect. All welding materials and gas tanks shall be promptly removed from the premises upon completion of each day's work or stored in a manner satisfactory to the owner. Welding and equipment shall conform to the American Welding Society's Code for Welding in Building Construction, latest edition as well as state and local laws and ordinances.

C. Provide all temporary ventilation, and ventilation air systems required during welding operations as required by OSHA.

3.11 AS-BUILT DRAWINGS

A. The Contractor shall provide a complete set of As-Built drawings showing actual installation and locations of all new and existing equipment, piping, and ductwork in the entire building. Schedules shall be revised to indicate actual equipment installed.

B. As-Built drawings shall be submitted as per contract requirements in accordance with Division 1 and shall be submitted in paper format for review. Accepted as builts shall then be submitted in AutoCAD format on hard disc.

3.12 CONDITIONS

A. Inspection: Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Verify that the work of this Section may be completed in strict accordance with all pertinent codes and regulations, the approved Shop Drawings, and the Manufacturers' recommendations.

B. Discrepancies: In the event of discrepancy, immediately notify the Engineer. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

3.13 INSTALLATION OF EQUIPMENT

A. Locations: Install all equipment in the locations shown on the approved Shop Drawings except where specifically otherwise approved on the job by the Owner and/or Engineer.

B. Interferences: Avoid interference with structure, and with work of other trades, preserving adequate headroom and clearing all doors and passageways to the approval of the Engineer.

C. Inspection: Check each piece of equipment in the system for defects, verifying that all parts are properly furnished and installed, and that all items function properly, and that all adjustments have been made.

3.14 CLOSING-IN OF UNINSPECTED WORK

A. General: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and accepted by the Engineer and by all other authorities having jurisdiction.

B. Uncovering: Should any of the work of this Section be covered up or enclosed before it has been completely inspected, tested, and approved, do all things necessary to uncover all such work. After the work has been completely inspected, tested, and approved, provide all materials and labor necessary and make all repairs necessary to restore the work to its original and proper condition at no additional cost to the owner.

3.15 BUILDING ACCESS

A. The Contractor shall inform himself fully regarding peculiarities and limitations of space available for the passage and installation of all equipment and materials under the Contract.

B. Verify and coordinate removal of existing construction and/or knock-down of equipment to suit conditions. Special attention should be given to equipment installation. Provide all labor and material to facilitate installation.

3.16 COOPERATION WITH OTHER TRADES PHASING

A. Cooperate with other trades in order that all systems in the work may be installed in the best arrangements.

B. Coordinate as required with all other trades to share space in common areas and to provide the maximum of access to each system.

C. This Contractor shall submit fully coordinated shop drawings showing all piping, ductwork and equipment, as well as relevant work of all other trades such as light, conduits, structural and steel, which may impact the final size or placement of piping, ductwork, equipment, diffusers and grilles.

D. The work shall be scheduled and phased in accordance with the requirements of the contract and the client. Prior to the commencement of work the HVAC contractor shall submit a schedule in writing to the Architect and owner for approval. There shall be no shutdowns of any systems without prior written approval from the owner.

3.17 CLEANING

A. It is the intent of the contract documents that all work, including the inside of equipment be left in a clean condition. All construction dirt shall be removed from material and equipment.

B. All removed items shall be taken off the premises and discarded in a manner satisfactory to the Owner.

3.18 COMPLETENESS

A. It is the intent of the contract documents to provide complete systems. Completeness shall mean not only that all material and equipment has been installed properly, but that all material and equipment is installed, adjusted, and operating as per the design intent in the opinion of the Engineer and in accordance with generally accepted industry good practice.

3.19 FIRE PREVENTION DURING HOT WORK

A. Before starting operations, the Contractor shall furnish trained personnel to provide fire watches for locations where hot work is to be performed. One fire watcher may observe several locations in a relatively small contiguous area. Contractor shall furnish suitable type, fully-charged, operable portable fire extinguisher to each fire watcher.

B. The Contractor shall provide fire watchers who know how to operate the fire extinguisher, how to turn on a fire alarm and how to summon the fire department.

C. Before starting operations, take suitable precautions to minimize the hazard of a fire communicating to the opposite side of walls, floors, ceilings and roofs from the operations.

3.20 SAFETY MEASURES

A. Hot work shall not be done in or near rooms or areas where flammable liquids or explosive vapors are present or thought to be present. A combustible gas indicator (explosimeter) test shall be conducted to assure that each area is safe. The Contractor is responsible for arranging and paying for each test.

B. Insofar as possible, the Contractor shall remove and keep the area free from all combustibles, including rubbish, paper and waste within a radius of 25 feet from hot operations.

C. If combustible material cannot be removed, the Contractor shall furnish fireproof blankets to cover such materials. At the direction of the owner floors, walls, and ceilings of combustible material shall be wetted thoroughly with water before, during, and after operations sufficiently to afford adequate protection.

D. Where possible, the Contractor shall furnish and use baffles of metal or gypsum board to prevent the spraying of sparks, hot slag and other hot particles into surrounding combustible material.

E. The Contractor shall prevent the spread of sparks and particles of hot metal through open windows, doors, and holes and cracks in floors, walls, ceilings and roofs.

F. Cylinders of gas used in hot work shall be placed a safe distance from the work. The Contractor shall provide hoses and equipment free of deterioration, malfunction and leaks.

Suitable supports shall be provided to prevent accidental overturning of cylinders. All cylinder control valves shall be shut off while in use with the gas pressure regulator set at 15 psi or less.

G. When hot work operations are completed or ended for the day, each location of the days work shall be inspected by the Contractor 30 to 60 minutes after completion of operations to detect for hidden or smoldering fires and to ensure that proper housekeeping is maintained. Contractor shall cleanup the area of work at the end of each shift or workday.

H. Where sprinkler protection exists, the sprinkler system shall be maintained without interruption while operations are being performed. If operations are performed close to automatic sprinkler heads, gypsum board sheets or damp cloth guards may be used to shield the individual heads temporarily. The heads shall be inspected by the Contractor immediately after hot work operations cease, to ensure all materials have been removed from the heads and that the heads have not been damaged.

I. Suitable type, fully-charged, operable portable fire extinguisher shall be available at all times during hot work operations.

J. If any of the above safeguards are not employed, or are violated, the Contracting owners Representative may, by written notice, stop the work until compliance is obtained. Such stoppage shall not relieve the Contractor form performing his work within the Contract period for the Contract price.

3.21 USE OF OWNERS EQUIPMENT

A. The contractor shall not use any the owner’s HVAC system or equipment, new or existing, for any purpose. The contractor shall provide temporary HVAC equipment, ductwork, power, and controls for use during construction for the purpose of ventilation or heating during the construction process. All such equipment, ductwork, power, and controls shall be removed and the completion of work.

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 01 Specification Sections, apply to this Section.

B. Division 24 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

1.4 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

C. NEMA MG 1 - Motors and Generators.

D. NFPA 70 - National Electrical Code.

1.5 REGULATORY REQUIREMENTS

A. Conform to UL Component Recognition for appropriate sizes.

B. Conform to NFPA 70 applicable electrical code, Underwriters Laboratories, Inc., and NEMA

C. Conform to New York State energy code.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.7 WARRANTY

A. Provide five-year manufacturer warranty for all motors larger than ½ horsepower.

PART 2 - PRODUCTS

MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. Gould.
2. Century.
3. General Electric.
4. Square D

2.2 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. All electric motors of sizes and types, as specified for driving mechanical equipment shall be provided under this section.

C. Electrical Service: All motors shall be 60 Hertz unless otherwise noted. Refer to Electrical Specifications for required electrical characteristics.

D. Motors: Design for continuous operation in 40° C environment, and for temperature rise in accordance with ANSI/NEMA MG limits for insulation class, Service Factor, and motor enclosure type. Motors shall be of sufficient size for duty to be performed.

E. Visible Nameplate: Indicating manufacturer's name and model number, motor horsepower, RPM, frame size, voltage, phase, cycles, full load amps, insulation system class, service factor, maximum ambient temperature, temperature rise at rated horsepower, minimum efficiency, power factor.

F. Electrical Connection: Conduit connection boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide screwed conduit connection in end frame. Size motor boxes to receive motor feeders and ground cable indicated on electrical drawing schedules.

G. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

H. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 MOTOR EFFICIENCY

A. Electric motors shall meet the minimum efficiency requirement of the following tables in accordance with International Energy conservation code when tested in accordance with DOE CFR 431. Performance data shall be certified by approved testing agency.

B. Subtype I motors – NEMA premium efficiency as per table NEMA MG 1 table 12-12 and International Energy Conservation code table 405.8(1). This shall apply to general purpose, T-frame, single speed, squirrel cage, induction type; 230/460-V, NEMA Designs A or B, continuous rated, 60 Hz, from 1 to 200 hp, 2-, 4- and 6-pole (3600-, 1800- and 1200-rpm), open and enclosed. Subtype I motors 250 hp to 500 hp motor efficiency shall be able NEMA MG 1 table 12-11 and International Energy Conservation Code table 405.8(1).

C. Subtype II motors – NEMA efficiency as per table NEMA MG 1 table 12-11 and International Energy Conservation code table 405.8(2). This shall apply to general purpose motors but can configured as U-frame motors; NEMA Design C motors; close-coupled pump motors; footless motors; vertical solid shaft normal thrust motors (as tested in a horizontal position); eight-pole (900 rpm) motors, and polyphase motors with a voltage of not more than 600 V (other than 230 or 460 V).

D. Minimum average full load efficiency of polyphase small electric motors up to 3 hp shall be in accordance with Table C405.8(3) of the International Energy Conservation Code

E. Minimum average full load efficiency for capacitor-start, capacitor-run and capacitor-start induction-run small electric motors up to 3 hp shall be in accordance with Table C405.8(4) of the International Energy Conservation Code.

2.4 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Service Factor: 1.15.

C. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

D. Multispeed Motors: Separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum AFBMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt centre line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

G. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.

H. Sound Power Levels: To NEMA MG 1.

I. Temperature Rise: Match insulation rating.

J. Insulation: Class B or better.

K. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

L. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.5 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Use part winding Start above 254T Frame Size: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

C. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

D. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.6 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, pre-lubricated sleeve ball bearings.

2.7 POWER FACTOR CORRECTION

A. Provide a capacitor for each three phase, single speed motor rated 3 HP or larger shall be provided to correct the full load power factor to 95%. The capacitor shall be mounted at the motor for connection across the motor terminals by Electrical Contractor

B. Capacitors:
1. Capacitors shall be totally enclosed, fused and with discharge resistors.
2. Capacitors based on nominal motor RPM shall be provided in accordance with the following table to correct power factor to 95% and verify sizes with motor manufacturer.

Motor HP	Capacitor KVAR 3600 RPM Motor	Capacitor KVAR 1800 RPM Motor
3	1.5	1.5
5	2	2
7.5	2.5	2.5
10	3	3
15	4	4
20	5	5
25	6	6
30	7	7
40	9	9
50	12	12
60	14	14

2.8 STARTERS

A. GENERAL

1. See specification Section 16485 and Division 1 for additional information.
2. Starters for motors operating at 120 volts shall be manual starters unless otherwise indicated. Starters for motors operating at other than 120 volts shall be magnetic starters.
3. All starters shall be enclosed. Enclosures shall be surface mounted NEMA 1 unless otherwise indicated.
4. Where weatherproof starters are required, the enclosure shall be NEMA 4.
5. It shall be verified that the correct overload heaters have been installed in the starter before energizing any motor. Sizing shall be based on motor nameplate current and taking into account any reduction in current due to power factor correction.
6. Alternate Manufacturers –
   a. Allen-Bradley
   b. Crouse-Hinds Co.
   c. Cutler-Hammer, Inc.

d. General Electric Co.
e. Square D Co.
f. Westinghouse Electric Corp.

B. MANUAL STARTERS

1. Two-pole, toggle operated, thermal overload device in each phase leg, handle guard for padlocking toggle handle and with indicated control and signal devices.

2. Where a motor is controlled automatically by an interlock or pilot device, a “HAND-OFF-AUTO” switch shall be provided in the starter cover. Where the rating of the interlock or pilot device is inadequate to control the motor currents directly, a properly rated contactor shall be provided between the controlling device and the motor.

3. An “ON” pilot light shall be provided in the starter cover.

C. MAGNETIC STARTERS

1. Starters shall be sized in accordance with NEMA standards and the following table except that starters shall not be smaller than NEMA size 0. Starters shall be provided with one N.O. electrical holding interlock, under voltage protection and two additional auxiliary contacts within the same enclosure. NEMA size starters shall be provided as follows:

STARTER SIZE	MAX HP AT 460 VOLTS
0	5
1	10
2	25

2. All starters shall be combination type with the starter and disconnect in the same enclosure. All starters shall be Type 2 coordination protected. Fuses shall be Bussman “Low Peak” type or equal sized at 125% of motor nameplate rating. Verify and coordinate requirements for fused disconnect switches with the Electrical Contractor prior to ordering starters.

3. Provide S.S.P.B. or H-O-A switches and pilot light in covers as required to facilitate control operation sequences.

D. CRITICAL FAULT

1. Where starters are not integral to equipment and are furnished and installed separately from equipment by the contractor, provide a 3 phase line voltage monitor by ICM Controls model 450 or approved equal. Unit shall be installed in the motor starter or in a separate enclosure with the same rating as the starter. It shall be arranged to monitor critical faults including phase loss or reversal, and when detected, de-energize the load. It shall monitor non-critical faults including high/low voltage, voltage unbalance and when detected, after a time delay de-energize the load.

PART 3 - EXECUTION

A. Suitable starting and controlling equipment and devices shall be furnished and installed as specified hereinafter and as shown on the Drawings. The starting equipment shall be arranged, generally, in control groups, or in certain cases, as isolated combination starters as specified or indicated. The Heating Ventilating and Air Conditioning Sequences of Operation, drawings and

specifications shall be referred to for the manner of control, operation and monitoring of motors and the electrically operated equipment.

B. A starter and disconnect switch or combination motor starter disconnect shall be provided for every motor and each and every electrically operated piece of equipment by this contractor except where complete starters and controls are furnished by the manufacturer of the motor or piece of equipment. Starters shall be internally wired to provide the required control operation and monitoring. All control devices such as push buttons, break-glass stations, alternators, relays, pilot lights, etc., shall be provided as required for operation of mechanical equipment. All roof top and remotely located equipment shall have remote starters as located on plan and shall have local disconnect switches. All equipment located in equipment rooms can use combination starters/disconnects located within line of site of controlled equipment. All starters and disconnect switches shall be in enclosures suitable for the environment in which they are installed. Starters and disconnect switches located in machine rooms shall use NEMA 1. Starters and disconnect switches located outdoors shall use NEMA 4x. Starters and disconnect switches located in machine rooms which are subject to potential water damage shall use NEMA 2

C. Starting equipment and devices specified in this section (and section 23 29 13 Variable Frequency Controllers), shall be furnished by the mechanical subcontractor and shall be installed by the Electrical subcontractor. In general, the mechanical subcontractor shall furnish all motor starters and disconnect switches except where they are an integral part of a motor control center, in this case starters and disconnects shall be provided, (furnished and installed), by the electrical contractor. The Electrical subcontractor shall also provide all wiring necessary to supply power to the electric motors specified under this section, including connections from the starters to the motors. Starters and disconnects shall also include variable frequency drives.

D. The mechanical Contractor shall furnish and install all wiring between control devices and controlled equipment furnished under this Section, including interlock control wiring between motor starters, and all automatic temperature control wiring. All wiring shall be installed in conformance with applicable codes and the requirements of the Electrical Division of the Specifications.

E. The Electrical Contractor shall furnish a 120-volt power source to temperature control panels and equipment requiring a separate 120-volt control power source. Power for control circuits for all devices connecting to motor starters shall be obtained from 120-volt control transformers provided in each starter operating at other than 120 volts. Provide transformers for all low voltage control systems as required.

F. Furnish detailed composite wiring diagrams and such other information necessary to assure the proper connection, operation and control of motorized equipment, including interlocks, automatic controls, safety controls and all auxiliary circuits.

G. All control units shall be furnished with a nameplate indicating which device or equipment it controls, the voltage. Additional nameplates on each push button, selector switch and pilot light indicating their functions shall be provided. Nameplates shall be laminated phenolic with white letters on black background, minimum 2” high.

H. All motors supplied either with equipment or installed separately that are to be used in conjunction with variable frequency drive shall be inverter duty motors.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Escutcheons.
6. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water stop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. Airex Manufacturing.
3. CALPICO, Inc.
4. Metraflex Company (The).
5. Link Seal

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel or Stainless steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, or Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. GPT; an EnPro Industries company.
3. Metraflex Company (The).
4. Proco Products, Inc.
5. Fernco

B. Description: Manufactured heavy rubber or EPDM, sleeve-to-pipe water stop assembly. Unit has rubber water stop collar with center opening to match piping OD. Connected with stainless steel hose clamps. Made for copper or plastic carrier pipes. Size up to 4” sleeve and 3” carrier pipe.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.6 ESCUTCHEONS

A. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

B. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

C. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

D. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.7 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

C. Coordinate the minimum size of sleeves with the pipe. Sleeves for plumbing piping shall be 2x the diameter of the service pipe.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position water stop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use galvanized steel sleeves and sleeve system for the following piping-penetration applications:

1. Exterior Concrete Walls above and below Grade:

2. Concrete Slabs-on-Grade:

3. Concrete Slabs above Grade:

4. Interior Partitions:

B. Use galvanized steel sleeves for the following piping-penetration applications:
1. Interior Partitions:

C. ESCUTCHEON INSTALLATION

D. Install escutcheons for all piping penetrations of finished walls, ceilings, and floors.

E. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
f. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
g. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.

2. Escutcheons for Existing Piping:

a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
e. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge.
f. Bare Piping in Equipment Rooms: Escutcheons not required
g.

F. Install floor plates for piping penetrations of equipment-room floors.

G. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.5 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230517

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. Bimetallic-actuated thermometers.
2. Filled-system thermometers.
3. Liquid-in-glass thermometers.
4. Thermowells.
5. Dial-type pressure gages.
6. Gage attachments.
7. Test plugs.
8. Test-plug kits.

B. Related Sections:

1. Section 221123 "Facility Natural-Gas Piping" for gas meters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 Thermometer Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Trerice, H. O. Co.
2. Watts; a Watts Water Technologies company.

3. Weiss Instruments, Inc.
4. Weksler Glass Thermometer Corp.

2.2 BIMETALLIC-ACTUATED THERMOMETERS

A. Standard: ASME B40.200.

B. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.

C. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.

D. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

E. Connector Size: 1/2 inch, with ASME B1.1 screw thread.

F. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

G. Window: Plain glass.

H. Ring: Stainless steel.

I. Element: Bimetal coil.

J. Pointer: Dark-colored metal.

K. Accuracy: Plus, or minus 1 percent of scale range.

2.3 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:
1. Standard: ASME B40.200.
2. Case: Sealed type, cast aluminum or drawn steel; 5-inch nominal diameter.
3. Element: Bourdon tube or other type of pressure element.
4. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
5. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Pointer: Dark-colored metal.
7. Window: Glass.
8. Ring: Stainless steel.
9. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 screw threads.
10. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.

11. Accuracy: Plus, or minus 1 percent of scale range.

2.4 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
2. Case: Cast aluminum; 6-inch nominal size.
3. Case Form: Back angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Window: Glass or plastic.
7. Stem: Aluminum or brass and of length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.

8. Connector: 3/4 inch, with ASME B1.1 screw threads.
9. Accuracy: Plus, or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
2. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
3. Case Form: Adjustable angle Back angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Window: Glass.
7. Stem: Aluminum and length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.

8. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
9. Accuracy: Plus, or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.5 DUCT-THERMOMETER MOUNTING BRACKETS

A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

2.6 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.

9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.7 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Trerice, H. O. Co.
b. Watts; a Watts Water Technologies company.
c. Weiss Instruments, Inc.
d. Weksler Glass Thermometer Corp.

B. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.

2. Case: Liquid-filled Sealed Solid-front, pressure relief type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Metal.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

C. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Standard: ASME B40.100.
2. Case: Liquid-filled Sealed type; cast aluminum or drawn steel; 4-1/2-inch nominal diameter with back flange and holes for panel mounting.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Metal.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.8 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of brass or stainless-steel pipe with NPS 1/4 or NPS 1/2 pipe threads.

C. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.9 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Trerice, H. O. Co.
2. Watts; a Watts Water Technologies company.
3. Weiss Instruments, Inc.
4. Weksler Glass Thermometer Corp.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: EPDM self-sealing rubber.

2.10 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Sisco Manufacturing Company, Inc.
2. Trerice, H. O. Co.
3. Watts; a Watts Water Technologies company.
4. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.

D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

E. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.

F. Carrying Case: Metal or plastic, with formed instrument padding.
1. meter system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.

H. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

I. Install remote-mounted pressure gages on panel.

J. Install valve and snubber in piping for each pressure gage for fluids (except steam).

K. Install valve and syphon fitting in piping for each pressure gage for steam.

L. Install test plugs in piping tees.

M. Install flow indicators in piping systems in accessible positions for easy viewing.

N. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

O. Install flowmeter elements in accessible positions in piping systems.

P. Install wafer-orifice flowmeter elements between pipe flanges.

Q. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.

R. Install permanent indicators on walls or brackets in accessible and readable positions.

S. Install connection fittings in accessible locations for attachment to portable indicators.

T. Mount thermal-energy meters on wall if accessible; if not, provide brackets to support meters.

U. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic coil in air-handling units.

3. Two inlets and two outlets of each hydronic heat exchanger.
4. Air side - supply air ducts.

V. Install pressure gages in the following locations:

1. Inlet and discharge of each pressure-reducing valve station
2. Inlet and outlet of strainers.
3. Inlet and outlet of coils
4. Suction and discharge side of each pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

D. Connect thermal-energy meter transmitters to meters.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each hydronic zone shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Direct or Remote-mounted, metal-case, vapor-actuated type.
3. Compact or Industrial-style, liquid-in-glass type.
4. Test plug with EPDM self-sealing rubber inserts.
5. Industrial-style, liquid-in-glass type.

B. Industrial type, liquid in glass type thermometers shall be installed at all the inlets and outlets of each of the following equipment
1. Hydronic pump
2. Hydronic boiler
3. Heat exchanger
4. Air handling units
5. Provide test with EPDM self-sealing rubber inserts

C. Thermometers at inlet and outlet of each hydronic coil in air-handling units or duct mounted and built-up central systems shall be one of the following:

1. Liquid-filled or Sealed, bimetallic-actuated type.
2. Direct or Remote-mounted, metal-case, vapor-actuated type.
3. Compact or Industrial-style, liquid-in-glass type.
4. Test plug with EPDM self-sealing rubber inserts.

D. Thermometers at return-, supply-, and mixed-air ducts shall be one of the following:

1. Liquid-filled or sealed, bimetallic-actuated type.
2. Direct or Remote-mounted, metal-case, vapor-actuated type.
3. Compact or Industrial-style, liquid-in-glass type.

E. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 0 to 250 deg F.

B. Scale Range for Air Ducts: 0 to 150 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at all the inlet and discharge connections of each of the following equipment shall be liquid filled and sealed direct mounting, metal case.
1. Pressure-reducing valve
2. Hydronic pump
3. Hydronic boiler
4. Air handling and duct mounted units coils
5. Provide test with EPDM self-sealing rubber inserts

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 0 to 160 psi.

END OF SECTION 230519

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. Bronze angle valves.
2. Globe valves.
3. Ball Valves
4. Butterfly Valves.
5. Check Valves
6. Gate Valves
7. Chainwheels.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle and globe valves closed to prevent rattling.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.1 for power piping valves.
6. ASME B31.9 for building services piping valves.

C. Refer to HVAC valve schedule articles for applications of valves.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valves in Insulated Piping:

1. Include 2-inchstem extensions.
2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

G. Valve Actuator Types:

1. Gear Actuator: For valves NPS 8 and larger.
2. Handlever: For valves NPS 6 and smaller.
3. Chainwheel: Device for attachment to gear, stem, or other actuator of size and with chain for mounting height, according to "Valve Installation" Article.

H. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. Crane; Crane Energy Flow Solutions.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Stockham; Crane Energy Flow Solutions.
f. Watts; a Watts Water Technologies company.
g. Keystone

GLOBE VALVES

2.2 BRONZE GLOBE VALVES

A. Class 150 Bronze Globe Valves:

1. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Bronze or PTFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

2.3 IRON GLOBE VALVES

A. Class 125 Iron Globe Valves:
1. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.
g. Operator: Handwheel or chainwheel.

B. Class 250 Iron Globe Valves:
1. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 500 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.
g. Operator: Handwheel or chainwheel.

BALL VALVES

2.4 BRASS BALL VALVES

A. Two-Piece Brass Ball Valves with Full Port and Brass Trim:
1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Full.

B. Two-Piece Brass Ball Valves with Full Port and Stainless-Steel Trim:
1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

C. Two-Piece Brass Ball Valves with Regular Port and Brass Trim:
1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Regular.

D. Two-Piece Brass Ball Valves with Regular Port and Stainless-Steel Trim:
1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Brass or bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.

j. Port: Regular.

2.5 BRONZE BALL VALVES

A. Two-Piece Bronze Ball Valves with Full Port and Bronze or Brass Trim:
1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

B. Two-Piece Bronze Ball Valves with Full Port and Stainless-Steel Trim:
1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

C. Two-Piece Bronze Ball Valves with Regular Port and Bronze or Brass Trim:
1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Regular.

BUTTERFLY VALVES

2.6 DUCTILE-IRON, GROOVED-END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:
   1. Description:

      a. Standard: MSS SP-67, Type I.
      b. CWP Rating: 175 psig.
      c. Body Material: Coated, ductile iron.
      d. Stem: Two-piece stainless steel.
      e. Disc: Coated, ductile iron.
      f. Seal: EPDM.

B. 300 CWP, Iron, Grooved-End Butterfly Valves:
   1. Description:

      a. Standard: MSS SP-67, Type I.
      b. NPS 8 and Smaller CWP Rating: 300 psig.
      c. NPS 10 and Larger CWP Rating: 200 psig.
      d. Body Material: Coated, ductile iron.
      e. Stem: Two-piece stainless steel.
      f. Disc: Coated, ductile iron.
      g. Seal: EPDM.

CHECK VALVES

2.7 BRONZE LIFT CHECK VALVES

A. Class 125 Lift Check Valves with Bronze Disc:
   1. Description:

      a. Standard: MSS SP-80, Type 1.
      b. CWP Rating: 200 psig.
      c. Body Design: Vertical flow.
      d. Body Material: ASTM B 61 or ASTM B 62, bronze.
      e. Ends: Threaded.
      f. Disc: Bronze.

B. Class 125 Lift Check Valves with Nonmetallic Disc:
   1. Description:

      a. Standard: MSS SP-80, Type 2.
      b. CWP Rating: 200 psig.
      c. Body Design: Vertical flow.
      d. Body Material: ASTM B 61 or ASTM B 62, bronze.
      e. Ends: Threaded.
      f. Disc: NBR or PTFE.

2.8 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:
   1. Description:

      a. Standard: MSS SP-80, Type 3.
      b. CWP Rating: 200 psig.
      c. Body Design: Horizontal flow.
      d. Body Material: ASTM B 62, bronze.
      e. Ends: Threaded.
      f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:
   1. Description:

      a. Standard: MSS SP-80, Type 4.
      b. CWP Rating: 200 psig.
      c. Body Design: Horizontal flow.
      d. Body Material: ASTM B 62, bronze.
      e. Ends: Threaded.
      f. Disc: PTFE.

C. Class 150, Bronze Swing Check Valves with Bronze Disc:
   1. Description:

      a. Standard: MSS SP-80, Type 3.
      b. CWP Rating: 300 psig.
      c. Body Design: Horizontal flow.
      d. Body Material: ASTM B 62, bronze.
      e. Ends: Threaded.
      f. Disc: Bronze.

D. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:
   1. Description:

      a. Standard: MSS SP-80, Type 4.
      b. CWP Rating: 300 psig.
      c. Body Design: Horizontal flow.
      d. Body Material: ASTM B 62, bronze.
      e. Ends: Threaded.
      f. Disc: PTFE.

2.9 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:
   1. Description:

      a. Standard: MSS SP-71, Type I.
      b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
      c. NPS 14 to NPS 24, CWP Rating: 150 psig.

d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.

B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:
1. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Composition.
h. Seat Ring: Bronze.
i. Disc Holder: Bronze.
j. Disc: PTFE.
k. Gasket: Asbestos free.

C. Class 250, Iron Swing Check Valves with Metal Seats:
1. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
c. NPS 14 to NPS 24, CWP Rating: 300 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.

GATE VALVES

A. Class 150, RS, Bronze Gate Valves:
1. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, OS&Y, Iron Gate Valves:
1. Description:

a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Disc: Solid wedge.
h. Packing and Gasket: Asbestos free.

C. Class 250, OS&Y, Iron Gate Valves:
1. Description:

a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
c. NPS 14 to NPS 24, CWP Rating: 300 psig.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Disc: Solid wedge.
h. Packing and Gasket: Asbestos free.

2.10 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries.
3. Trumbull Industries.

B. Description: Valve actuation assembly with sprocket rim, chain guides, chain, and attachment brackets for mounting chainwheels directly to handwheels.

1. Sprocket Rim with Chain Guides: Ductile or cast iron Aluminum, of type and size required for valve.
2. Chain: Hot-dip-galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for valves NPS 6 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. Install valve tags. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

G. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated on plan use the following:

1. Throttling Service except Steam: Globe valves.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze, check, ball or globe valves, Class 150, bronze nonmetallic disc, with soldered or threaded ends.

B. Pipe NPS 2-1/2 and Larger: check, globe valves, or gate Class 250 iron body with flanged ends.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Pipe stands.
4. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers 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. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. B-line, an Eaton business.
    b. Flex-Strut Inc.
    c. Thomas & Betts Corporation; A Member of the ABB Group.
    d. Unistrut; Part of Atkore International.
    e. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.

3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.
7. Metallic Coating: Electroplated zinc, Hot-dipped galvanized, Mill galvanized, In-line, hot galvanized, or Mechanically-deposited zinc.

8. Paint Coating: Epoxy or Alkyd.
9. Plastic Coating: PVC or Polyurethane.
10. Combination Coating:

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Anvil International.
    b. ERICO International Corporation.
    c. PHD Manufacturing, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.

3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.
7. Coating: Zinc, Paint or PVC.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Clement Support Services.
2. ERICO International Corporation.
3. National Pipe Hanger Corporation.
4. Pipe Shields Inc.
5. Piping Technology & Products, Inc.
6. Rilco Manufacturing Co., Inc.

B. Insulation-Insert Material for Hot and cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

C. Flashing;
Metal Flashing: 26gage galvanized steel.

1. Metal Counter-flashing: 22 gage thick galvanized steel.

2. Flexible Flashing: 47 mil thick sheet butyl or other material compatible with roofing. Verify with roofing manufacturer.

3. Caps: Steel, 22-gage minimum; 16 gages at fire resistant elements.

D. Sleeves:
1. Ductwork Sleeve 18-gauge Installation and Closure for Fire Rated Walls and Floors: Fire damper assembly with continuous angles on all sides as per NFPA-90A requirements.

2. Provide and install sleeves for all penetrations in accordance with Division 1.

E. Escutcheons;
1. Chrome plated cast brass escutcheons with set screws on all exposed piping at wall penetrations in finished spaces.

F. Hanger Rods:
1. Hanger Rods: Hot rolled steel threaded both ends, threaded one end, or continuous threaded. In accordance with the following schedule.

HANGER ROD SIZE SCHEDULE	
Pipe Size (in)	Min Rod Dia (in)
¾” to 2”	3/8”
½” to 3-1/2”	½”
4” to 5”	5/8”
6”	¾”
8” to 12”	7/8”
14”	1”
16” to 18”	1-1/8”
20”	1-1/4”
24”	1-1/2”
30”	1-7/8”

2. Hanger spacing shall be in accordance with the following schedule for maximum allowable distance. Provide hanger all changes in direction.

PIPE SUPPORT SPACING SCHEDULE		
Pipe Material/ Size (in)	Maximum Horizontal Spacing (ft)	Maximum Vertical Spacing (ft)
Steel		
Up to 1 ¼”	8	15
1 ½” to 2 ½”	10	15
3” and over	12	15
Copper Pipe	8	10
Copper Tubing		
Up to 1 ¼”	6	10
1 ½” and over	8	10
PVC / HDPE		
Up to 1”	3	10
1 1/4” and over	4	10

3. Fiberglass piping supports spacing shall be in accordance with the manufactures guidelines.

2.9 VIBRATION ISOLATION HANGERS

A. Vibration isolation pipe hangers; pre-compressed and locked at the rated deflection by means of a resilient up-stop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30° capability. Hangers shall be type PC30N as manufactured by Mason Industries, Inc

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to the manufacturer’s written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and

larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles on all piping with roller hangers installed outside of insulation. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier not on roller hangers. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply cold galvanizing-repair paint to comply with ASTM A 780. ZRC cold galvanizing compound

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports or metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
5. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
6. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
7. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3.
8. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
9. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
10. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
11. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
12. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
13. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
14. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
15. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
9. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
10. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
11. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

12. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
13. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
9. Install vibration isolation hangers or supports on all piping connected to motor driven equipment for a distance of 20’ or the first two hangers.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.7 MISCELLANEOUS:

A. Equipment bases and supports.
1. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment. Champers edges all four side. Provide dowels into concrete floor for equipment that is seismically braced.
2. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment. Provide for all equipment, pumps, air handling units, etc.
3. Construct supports of steel members. Brace and fasten with flanges bolted to structure. Provide rigid anchors for pipes after vibration isolation components are installed.

B. Flashing:
1. Provide flexible flashing and metal counter-flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

2. Flash piping projecting above finished roof surface with prefabricated steel reinforced boot and counter flashing sleeve.

C. Sleeves:
1. Sleeves are required for all piping passing through walls and/or slabs. Sleeve diameter to be large enough to accommodate insulated piping.
2. Sleeves through interior non-fire rated walls are to have annular space between pipe and sleeve filled with materials specified in Division 1.
3. Sleeves thru fire rated walls to have annular space filled with fire stopping wrapping strips and expanding caulking applied with a caulking gun for a minimum depth of 3” or in another manner suitable for the application as recommended by the manufacturer. See Division 1.

D. Escutcheons:
1. Provide escutcheons on all wall pipe penetrations that are visible outside MER spaces. All escutcheons shall be chrome plated.

END OF SECTION

PART 1 GENERAL

1.1 WORK INCLUDED

A. Identification of mechanical products installed under Division 23.

1.2 REFERENCES

A. ASME A13.1 – Scheme for the Identification of Piping Systems

1.3 SUBMITTALS

A. Submittals as per contract requirements.

B. See Division 1 list of wording, symbols, letter size, and color coding for mechanical identification.

C. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Instructions: Indicate installation instructions, special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

F. Valve Tag chart.

PART 2 PRODUCTS

2.1 NAMEPLATES, TAGS, MARKERS, ETC

A. Manufacturer: W.H. Brady Co., Signmark Div

B. Acceptable manufacturers offering equivalent products

1. Atlantic Engraving Company.
2. Seton Name Plate Co.
3. MSI Services
4. Substitutions as per Contract Requirements.

C. Description: Nameplates should be as specified in Division 1.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials

B. Prepare surfaces in accordance with contract requirements.

3.2 INSTALLATION

A. Install tags, markers, etc. in conformance with Division 1.

B. Unless otherwise specified, color shall conform with ANSI/ASME A13.1

C. Install identifying devices after completion of coverings and painting.

D. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

E. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer. For unfinished cloth covering, apply paint primer before applying labels.

F. Install tags using corrosion resistant chain. Number tags consecutively by location.

G. Apply stencil painting in accordance with contract requirements.

H. Identify all equipment, including pumps, air handlers, air cooled condensers, boilers, chillers, pumps, packaged AC units, and hot water heater with nameplates. Small devices, such as in-line pumps, may be identified with metal tags. Identify service of all air handling units, packaged roof top units, ac units, and split systems. I.E. Ground floor offices. A plastic lamacoid placard shall be fastened to each unit with a full list of all of the rooms served by that unit.

I. Identify control panels and major control components outside panels with nameplates.

J. Identify valves in main and branch piping with brass tags. Main shutoff valves for boiler shall be furnished with special wording as required by ASME IV HG 710.5 "Supply or Return Valve No. X - Do Not Close Without Also Closing Supply or Return Valve No. Y". Tags shall be provided for all new HVAC and related systems valves. Including heating water, CW make-up. This shall apply to new valves and on re-piped existing equipment such as the fuel oil system.

K. Tag automatic controls, instruments, and relays. Key to control schematic.

L. Identify piping, concealed or exposed, with markers. Use tags on piping 3/4-inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction. Labeling shall be in conformance with OSHA and ANSI A13.1.

M. Identify all ductwork every 20’ with flow arrows and unit or air handler served as well as service, such as SUPPLY AIR, RETURN AIR, EXHAUST AIR. Etc

N. All smoke purge system components (including supply and exhaust ductwork) shall be clearly identified as such by stenciling the function and zone on the components, e.g., Smoke Purge Supply - Zone 2; Smoke Purge Exhaust - Zone 3; Smoke Damper No. 5; etc. Stenciling shall be 6" high red letters located (every 10 feet along duct).

O. Identify all Smoke Dampers and Fire Dampers. All dampers shall be sequentially numbered by floor. For example fire damper - FD-1-1 (Fire damper #1, floor 1) Tag shall be 1" high red letters located on damper. Provide red dot stencil on ceiling below damper.

P. Provide permanent labels for all controls and limits which state function of each control and control set-points.

END OF SECTION

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

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. Balancing Air Systems:

    a. Constant-volume air systems.

2. Testing, Adjusting, and Balancing Equipment:
    a. Motors.
    b. Condensing units.
    c. Air handling units
    d. Packaged roof top units

3. Testing, adjusting, and balancing existing systems and equipment.
4. Duct leakage tests.
5. Control system verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.4 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the engineer, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:

    a. The Contract Documents examination report.
    b. The TAB plan.
    c. Needs for coordination and cooperation of trades and subcontractors.
    d. Proposed procedures for documentation and communication flow.

1.5 ACTION SUBMITTALS

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Certified TAB reports.

D. Sample report forms.

E. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.7 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

1.8 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete, and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

2. Hydronics:

a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
b. Piping is complete with terminals installed.
c. Water treatment is complete.
d. Systems are flushed, filled, and air purged.
e. Strainers are pulled and cleaned.
f. Control valves are functioning per the sequence of operation.
g. Shutoff and balance valves have been verified to be 100 percent open.
h. Pumps are started and proper rotation is verified.
i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
j. Variable-frequency controllers' startup is complete, and safeties are verified.
k. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111 NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
   1. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
   2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR ALL SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

M. Code requirements;

Each supply air outlet and zone terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the International Mechanical Code. Discharge dampers used for air-system balancing are prohibited on constant-volume fans and variable volume fans with motors 10 hp and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power greater than 1 hp, fan speed shall be adjusted to meet design flow conditions.

Therefore, all fans greater than 10 hp shall be provided with variable frequency drives for speed control.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

    a. Measure static pressure directly at the fan outlet or through the flexible connection.
    b. Measure static pressure directly at the fan inlet or through the flexible connection.
    c. Measure static pressure across each component that makes up the air-handling system.
    d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.6 GENERAL PROCEDURES FOR ALL HYDRONIC SYSTEMS

A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:

1. Check liquid level in expansion tank.
2. Check highest vent for adequate pressure.
3. Check flow-control valves for proper position.
4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
5. Verify that motor starters are equipped with properly sized thermal protection.
6. Check that air has been purged from the system.

D. Code requirements;
1. Individual hydronic heating and cooling coils shall be equipped with means for balancing and measuring flow. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the capability to measure pressure across the pump, or test ports at each side of each pump.

3.7 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Adjust pumps to deliver total design gpm.

1. Measure total water flow.

a. Position valves for full flow through coils.
b. Measure flow by main flow meter, if installed.
c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.

2. Measure pump TDH as follows:

    a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
    b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
    c. Convert pressure to head and correct for differences in gage heights.
    d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
    e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

B. Adjust flow-measuring devices installed in mains and branches to design water flows.

1. Measure flow in main and branch pipes.
2. Adjust main and branch balance valves for design flow.
3. Re-measure each main and branch after all have been adjusted.

C. Adjust flow-measuring devices installed at terminals for each space to design water flows.

1. Measure flow at terminals.
2. Adjust each terminal to design flow.
3. Re-measure each terminal after it is adjusted.
4. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
5. Perform temperature tests after flows have been balanced.

D. For systems with pressure-independent valves at terminals:

1. Measure differential pressure and verify that it is within manufacturer's specified range.
2. Perform temperature tests after flows have been verified.

E. For systems without pressure-independent valves or flow-measuring devices at terminals:

1. Measure and balance coils by either coil pressure drop or temperature method.
2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

F. Verify final system conditions as follows:

1. Re-measure and confirm that total water flow is within design.
2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
3. Mark final settings.

G. Verify that memory stops have been set.

3.8 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals, and proceed as specified above for hydronic systems.

B. Adjust the variable-flow hydronic system as follows:

1. Verify that the differential-pressure sensor is located as indicated.
2. Determine whether there is diversity in the system.

C. For systems with no diversity:

1. Adjust pumps to deliver total design gpm.

a. Measure total water flow.

1) Position valves for full flow through coils.
2) Measure flow by main flow meter, if installed.
3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.

b. Measure pump TDH as follows:

1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
3) Convert pressure to head and correct for differences in gage heights.
4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

2. Adjust flow-measuring devices installed in mains and branches to design water flows.

a. Measure flow in main and branch pipes.
b. Adjust main and branch balance valves for design flow.
c. Re-measure each main and branch after all have been adjusted.

3. Adjust flow-measuring devices installed at terminals for each space to design water flows.

a. Measure flow at terminals.
b. Adjust each terminal to design flow.
c. Re-measure each terminal after it is adjusted.
d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
e. Perform temperature tests after flows have been balanced.

4. For systems with pressure-independent valves at terminals:

a. Measure differential pressure and verify that it is within manufacturer's specified range.
b. Perform temperature tests after flows have been verified.

5. For systems without pressure-independent valves or flow-measuring devices at terminals:

a. Measure and balance coils by either coil pressure drop or temperature method.
b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

6. Prior to verifying final system conditions, determine the system differential-pressure set point.
7. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
8. Mark final settings and verify that all memory stops have been set.
9. Verify final system conditions as follows:

a. Re-measure and confirm that total water flow is within design.
b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
c. Mark final settings.

10. Verify that memory stops have been set.

D. For systems with diversity:

1. Determine diversity factor.
2. Simulate system diversity by closing required number of control valves, as approved by the design engineer.
3. Adjust pumps to deliver total design gpm.

a. Measure total water flow.

1) Position valves for full flow through coils.
2) Measure flow by main flow meter, if installed.
3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.

b. Measure pump TDH as follows:

1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
3) Convert pressure to head and correct for differences in gage heights.
4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

4. Adjust flow-measuring devices installed in mains and branches to design water flows.

    a. Measure flow in main and branch pipes.
    b. Adjust main and branch balance valves for design flow.
    c. Re-measure each main and branch after all have been adjusted.

5. Adjust flow-measuring devices installed at terminals for each space to design water flows.

    a. Measure flow at terminals.
    b. Adjust each terminal to design flow.
    c. Re-measure each terminal after it is adjusted.
    d. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
    e. Perform temperature tests after flows have been balanced.

6. For systems with pressure-independent valves at terminals:

    a. Measure differential pressure, and verify that it is within manufacturer's specified range.
    b. Perform temperature tests after flows have been verified.

7. For systems without pressure-independent valves or flow-measuring devices at terminals:

    a. Measure and balance coils by either coil pressure drop or temperature method.
    b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

8. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance terminals that were just opened.
9. Prior to verifying final system conditions, determine system differential-pressure set point.
10. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
11. Mark final settings and verify that memory stops have been set.
12. Verify final system conditions as follows:

    a. Re-measure and confirm that total water flow is within design.
    b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
    c. Mark final settings.

13. Verify that memory stops have been set.

3.9 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

A. Balance the primary circuit flow first.

B. Balance the secondary circuits after the primary circuits are complete.

C. Adjust pumps to deliver total design gpm.

1. Measure total water flow.

a. Position valves for full flow through coils.
b. Measure flow by main flow meter, if installed.
c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.

2. Measure pump TDH as follows:

a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
c. Convert pressure to head and correct for differences in gage heights.
d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

D. Adjust flow-measuring devices installed in mains and branches to design water flows.

1. Measure flow in main and branch pipes.
2. Adjust main and branch balance valves for design flow.
3. Re-measure each main and branch after all have been adjusted.

E. Adjust flow-measuring devices installed at terminals for each space to design water flows.

1. Measure flow at terminals.
2. Adjust each terminal to design flow.
3. Re-measure each terminal after it is adjusted.
4. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
5. Perform temperature tests after flows have been balanced.

F. For systems with pressure-independent valves at terminals:

1. Measure differential pressure and verify that it is within manufacturer's specified range.
2. Perform temperature tests after flows have been verified.

G. For systems without pressure-independent valves or flow-measuring devices at terminals:

1. Measure and balance coils by either coil pressure drop or temperature method.
2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

H. Verify final system conditions as follows:

1. Re-measure and confirm that total water flow is within design.
2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
3. Mark final settings.

I. Verify that memory stops have been set.

3.10 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.11 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record fan and motor operating data.

3.12 DUCT LEAKAGE TESTS

A. Ducts designed to operate at static pressures of 3 inches w.g. or greater shall be sealed in accordance with specifications Section 23 31 13 Metal Ducts. In addition, ducts and plenums shall be leak tested in accordance with the procedures given SMACNA *HVAC Air Duct Leakage Test Manual.* Air leakage rates must *(CL)* less than or equal to 4.0 as determined in accordance with Equations below

1. $CL=F/P^{0.65}$ where:
2. *F* -The measured leakage rate in cfm per 100 square feet of duct surface.
3. *P* -The static pressure of the test.

B. Documentation shall be furnished by the test and balancing contractor demonstrating that representative sections totaling at least 25 percent of the duct area have been tested and that all tested sections meet the requirements of this section.

C. Perform duct pressure testing in coordination with Installer.

D. Verify that proper test methods are used and that leakage rates are within specified tolerances.

E. Report; submit a report indicating which ductwork sections were tested. Provide single line or double line duct submittal drawing. The drawing shall indicate all systems in their entirety to 3/8’ =1’-0” scale. Sections that air leakage tested shall be clearly indicated.

F. The report shall include full test procedure including how the ductwork was isolated for pressure testing, the pressure of the test and the duration of the test.

G. Submit duct pressure test procedures used for this project.

H. Submit summary of test results on a section by section basis, to include all CL, F,P and time.

I. Witness the duct pressure testing performed by Installer.

J. Verify that proper test methods are used and that leakage rates are within specified tolerances.

K. Report deficiencies observed.

3.13 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.14 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus, or minus 10 percent.
2. Air Outlets and Inlets: Plus, or minus 10 percent.
3. Heating-Water Flow Rate: Plus, or minus 10 percent.
4. Cooling-Water Flow Rate: Plus, or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.15 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.16 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings, including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit and Packaged Rooftop Units Test Reports: include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Filter static-pressure differential in inches wg.
    f. Preheat-coil static-pressure differential in inches wg.
    g. Cooling-coil static-pressure differential in inches wg.
    h. Heating-coil static-pressure differential in inches wg.
    i. Outdoor airflow in cfm.
    j. Return airflow in cfm.
    k. Outdoor-air damper position.
    l. Return-air damper position.
    m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

    a. System identification.
    b. Location.

c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.

d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

I. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

K. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.17 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of commissioning authority.

B. Commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.

F. Prepare test and inspection reports.

3.18 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Ductwork insulation.

B. Duct Liner.

C. Insulation jackets.

1.02 RELATED SECTIONS

A. Section 23 05 53 - Identification for HVAC Piping and Equipment.

B. Section 23 31 13 - Ductwork.

1.03 REFERENCES

A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

B. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. NAIMA National Insulation Standards.

E. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

F. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

H. ASHRAE 90-75 – Insulation Standards

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
1. Sheet Form Insulation Materials: 12 inches square.
2. Sheet Jacket Materials: 12 inches square.
3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years' experience approved by manufacturer.

1.06 REGULATORY REQUIREMENTS

A. Materials: Flame spread/fuel contributed/smoke developed rating of 25/50/50 in accordance with NFPA 255.

B. Insulation thickness shall comply with all applicable energy conservation codes.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - INSULATION

A. Owen Corning Fiberglass Corp.

B. Manville Industrial Products

C. Certain Teed Corporation

D. 3M Corporation "Firemaster" for Kitchen Exhaust

E. Substitutions: Under provisions of Division 1.

2.02 GLASS FIBER, RIGID

A. Type A: Flexible glass fiber duct insulation; ANSI/ASTM C612; commercial grade; “K” value of 0.25 at 75º F; minimum density of 1-1/2 pounds per cu. ft.; factory applied vapor barrier jacket of 0.7 mil minimum aluminum foil laminated to glass fiber reinforced Kraft paper. Similar to Owens-Corning type FRK-25-ED Type 150 commercial grade.

B. Type B: Rigid glass fiber board insulation with resin binder; ANSI/ASTM C612, Class 1; “K” value of 0.23 at 75º F minimum density of 6 pounds per cu. ft; factory applied white Kraft faced flame retardant vapor barrier jacket of aluminum laminated to heavy Kraft paper with a flame-retardant snuffer type adhesive and reinforced with glass fibers; permeability of 0.2. Similar to Owens-Corning type 705 with AST jacket.

C. Type C: Molded block or board insulation made of asbestos free hydrous calcium silicate; “K” value of 0.42 at 200º F; minimum density of 14 pounds per cubic foot; temperature range up to 1200º F.

D. Type D1: Flexible Glass Duct Liner: (For standard applications)

ANSI/ASTM C553; “K” value of 0.23 at 75º F; minimum density of 1.5 pounds per cu. ft.; surface finish of black pigmented fire-resistant resilient mastic coated on air side for maximum velocity of 4000 feet per minute.

a. Maximum Thermal Conductivity

1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

b. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

c. Solvent Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

E Type D2: Flexible Elastomeric Duct Liner: (Wet Or Damp Applications Including Natatorium And Saunas).

Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
2. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

F. Type “E” – Fire resistant duct wrap consisting of light weight, non-asbestos high temperature non-organic ceramic fiber blanket encapsulated in foil/scrim having a service temperature rating of 2300º F. Wrap shall be applied in two

temperature layers to provide a two-hour rated enclosure assembly. Bonding material shall be 304 stainless steel, ¾" wide and .015" thick.

G Adhesives: Waterproof fire-retardant type. Smoke and flame spread rating less than 50.

H. Indoor Jacket: Pre-sized glass cloth, minimum 7.8 oz/sq. yd unless otherwise specified above.

I. Outdoor Jackets: Insulate as per the specification and jacket with Polyguard Insul-wrap 50W Membrane. For watertight insulation jacket install as per manufacturers recommendations. Furnish all mastics and adhesives as per manufacture system.

1.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA, Inc.
b. Armacell LLC.
c. Foster Brand; H. B. Fuller Construction Products.
d. K-Flex USA.

C. Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1.3 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

1.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F
4. Color: Aluminum.

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.

3. Service Temperature Range: Minus 40 to plus 250 deg F
4. Color: White.

PART 3 EXECUTION

3.01 EXAMINATION

A. Install insulation materials only after ductwork has been sealed, tested and approved.

B. All insulated surfaces are to be cleaned and dried of any foreign material. This includes but is not limited to oil, water, dirt, rust and scale. Completely cover the entire surface to present a tight, smooth appearance.

3.02 INSTALLATION

A. Division 1 - Quality Control: Install materials in accordance with manufacturer's instructions, specification requirements and in compliance with local code.

B. Install in accordance with NAIMA National Insulation Standards.

C. Apply insulation in such a way as to permit expansion and/or contraction of metal without causing damage to insulation, joints, seams or finish.

D. Do not apply additional coats of mastic, adhesive, or sealers until previous coats have thoroughly dried.

E. Fill in all surface imperfections such as chipped edges, small joints, cracks, holes and small voids with materials o match insulation. Make smooth with a skim coat of insulation cement. Extend surface finish to protect all surfaces and leave no exposed edges.

F. Provide flashing for insulation installed outdoors to enclose all exposed edges or ends.

G. Repair existing insulation where damaged by new work. Use materials to match existing.

H. Cut, score or miter insulation to fit the slope and contour of surface to be covered. Insulation up to 3 inches thick to be applied in single layer. Over 3 inches apply in multiple layers, with joints staggered.

3.03 DUCT INSULATION SCHEDULE

Service	Type	Insulation Thickness
[1]Interior H&V, AC systems; SA, RA & EA, ductwork that is exposed in equip rooms.	B	1-1/2"

[1]Interior H&V, AC systems; SA, RA & EA including flexible run outs, that is concealed.	A	2"
Outside air intake ductwork All	B	1 1/2"
[2]Exterior H&V, AC systems; SA, RA & RA, ductwork that that is exposed outdoors.	B	2”
Acoustically line all SA & RA ductwork for a distance of 20’ from fan inlet and outlet and 10’ downstream of all VAV boxes.	D1/D2	1/2”
[5]Interior exposed H&V, AC systems; SA, RA located in conditioned spaces rectangular, spiral round or oval ductwork.		
Located in conditioned space	D1/D2	1"
Located in unconditioned space, plenum or equipment room.	D1/D2	11/2”
Kitchen hood exhaust (grease duct) layers.	E	2” applied in (2) 1”

1. Insulation Thickness shall be no less than the size indicated or the height of standing seams or angle bracing.
2. Reduce external insulation to 1” for internally lined ductwork except for outdoor installations. On outdoor installations insulation thickness shall be as scheduled but not less than the height of standing seams or angle bracing.
3. Outside air intake and Kitchen exhaust ducts shall not be internally lined.
4. Smoke purge system supply and exhaust ducts passing through a rated Exit-way or within a fire-rated suspended ceiling assembly and all Kitchen Hood exhaust ducts shall be wrapped with thermal fiber - two (2) hour or encased in a two (2) hour rated enclosure. Trapeze hangers to be outside of thermal wrapping.
5. All square, round, oval or rectangular ductwork that is exposed to view in finished spaces shall be internally insulated.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation

B. Jackets and accessories

1.02 RELATED SECTIONS

A. Section 23 05 53 – Identification for HVAC Piping and Equipment.

B. Section 23 21 13 - Hydronic Piping.

1.03 REFERENCES

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.

C. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

D. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

E. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

F. ASTM C547 - Standard Specification for Mineral Fiber Preformed Pipe Insulation

G. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.

H. ASTM C578 - Standard Specification for Preformed, Cellular Polystyrene Thermal Insulation

I. ASTM C610 - Standard Specification for Expanded Perlite Block and Pipe Thermal Insulation

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

K. NAIMA National Insulation Standards

L. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials

M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

N. ASHRAE 90-75 - Insulation Standards

1.04 SUBMITTALS FOR REVIEW

A. Division 1 – Submittal Requirements.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

D. Sustainable Design Submittals:
1. Product Data: For adhesives, mastics, and sealants, indicating VOC content.
2. Laboratory Test Reports: For adhesives, mastics, and sealants, indicating compliance with requirements for low-emitting materials.

E. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with a minimum of three years' experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with NFPA 255

B. Insulation thickness shall comply with applicable Energy Conservation Codes.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Pittsburgh Corning Corporation

B. Certainteed Corporation.

C. Armstrong Corporation.

D. Manville Industrial Products.

E. Owens-Corning Fiberglass Corporation

F. Polyguard

2.02 INSULATION

A. Type A: Molded glass fiber insulation; ANSI/ASTM C547; 'k' value of 0.23 at 75º F; noncombustible. Minimum density of 3.5 lbs./cu. Ft.; temperature range 35º F to 450º F.

B. Type B: Cellular glass insulation; ASTM C552; 'K' Value of 0.53 at 75°F; non-combustible. Minimum density of 8.0 lbs./cu. ft. similar to Pittsburgh Corning Foamglas.

C. Type C: Elastomeric insulation; ASTM C518, C177; 'K' Value of 0.27 at 75°F; non-combustible. Similar to Armstrong “AP Armaflex”; temperature range -40º F to 220º F. When used outdoors the insulation shall be coated with UV protection coating as per the manufactures requirements.

D. Type D; Underground engineered pipe insulation system shall be as follows;
Service pipe insulation shall be spray applied .16k-factor, R141B blowing agent, nominal 2 pound per cubic foot density, polyurethane foam for straight sections and preformed polyurethane foam for all fittings. Insulation shall not be less than 2” and shall be Perma-pipe polytherm.

2.03 JACKETS

A. Interior Applications:

1. Insulation Type A - Factory applied, white, flame retardant, all service (ASJ) vapor barrier jacket of .001" aluminum foil laminated to Kraft paper with a flame retardant snuffer type adhesive reinforced with glass fibers and having a self sealing lap. Provide 2" longitudinal lap and 4" circumferential sealing strips. Permeability .02 perm.

B. Exterior Applications:

1. Insulation Type A thickness as scheduled with ASJ vapor barrior jacket - Cover factory interior jacket with Alumaguard Cool Wrap by Polyguard rubberized bitumen membrane designed specifically to be installed over insulation on exterior piping, tanks, vessels, and equipment. The membrane shall be 'peel and stick', self-healing if punctured, UV stable, and will expand and contract with the mechanical system. All seams shall be sealed watertight. Permeability .0053 perm

C. Piping exposed in Mechanical Rooms or any space:

1. All exposed piping and fittings shall be completely covered with white Zeston 2000 PVC insulated piping and fitting covers. Apply as per manufacturer with perma weld adhesive.

D. Underground applications: (not used)

1. All straight sections of the insulated piping system shall be filament wound, polyester resin/fiberglass reinforcement composite directly applied on the insulating foam. The jacket shall be either filament wind fiberglass directly onto the polyurethane foam or injected foam into a fiberglass outer casing.

2. Fiberglass outer casing shall be A.O. Smith Red Thread or Ameron Bondstrand 3000. Thermoplastic casing material that are not rated for temperatures above 140 degrees F will not be allowed, e.g., PVC or HDPE. The minimum thickness for FRP jacket shall be as 0.55”.

2.04 ACCESSORIES

A. Insulation Bands: ¾" wide; 0.007-inch-thick aluminum.

B. Metal Jacket Bands: 3/8" wide; 0.015-inch-thick aluminum.

C. Insulating Cement: ANSI/ASTM C195; hydraulic setting mineral wool.

D. Finishing Cement: ASTM C449

E. Fibrous Glass Cloth: Untreated; 9 oz/sq. yd weight.

F. Adhesives: Compatible with insulation and fire retardant.

2.05 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

C. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.

1. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
2. Wet Flash Point: Below 0 deg F.
3. Service Temperature Range: 40 to 200 deg F
4. Color: Black.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Adhesive: As recommended by mineral fiber manufacturer and with a VOC content of 80 g/L or less.

2.06 MASTICS AND COATINGS

A. Mastic and coating terminology is used interchangeably in this article. Manufacturers refer to vapor-barrier formulations and vapor-retarder formulations as "mastics" or "coatings." Low-permeance mastics and coatings are termed "vapor retarders." Products with a perm rating of greater than 1.0 are called "breathable." Consider ambient conditions and operating temperatures when selecting mastics and coatings. Consider using water-based mastics and coatings for environmental reasons.

B. Materials shall be compatible with insulation materials, jackets, and substrates.

2.07 LAGGING ADHESIVES

A. Adhesives shall comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
   1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
   2. In "Service Temperature Range" Subparagraph below, more manufacturers can comply if first option is retained; consult manufacturers.
   3. Service Temperature Range: 20 to plus 180 deg F.
   4. Color: White.

2.08 SEALANTS

A. Sealants are categorized into "joint sealants" and "flashing sealants." Joint sealants are primarily used for vapor-sealing longitudinal seams and butt joints of insulation materials. Flashing sealants are primarily used for sealing jacket and mastic materials.

B. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.

C. Joint Sealants:
   1. Permanently flexible, elastomeric sealant.
      a. Service Temperature Range: Minus 150 to plus 250 deg F
      b. Color: White or gray.

D. FSK and Metal Jacket Flashing Sealants:
   1. Fire- and water-resistant, flexible, elastomeric sealant.
   2. Service Temperature Range: Minus 40 to plus 250 deg F
   3. Color: Aluminum.

E. ASJ Flashing Sealants and PVDC and PVC Jacket Flashing Sealants:
   1. Fire- and water-resistant, flexible, elastomeric sealant.
   2. Service Temperature Range: Minus 40 to plus 250 deg F
   3. Color: White.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with all foreign material removed. This includes but is not limited to water, oil, dirt, scale and rust.

D. Only insulation and finish materials including adhesive cements and mastic which conform to the requirements of all-governing codes and ordinances shall be used.

3.02 INSTALLATION

A. Division 1 – Quality Control: Install materials in accordance with manufacturer’s instructions and the best practice of the trade.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulation on all piping shall be vapor sealed. On insulated piping with vapor barrier, insulate all fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints. Vapor seal all exposed edges with jacket material and vapor barrier type adhesive.

D. Repair or replace any existing insulation and surface finish disturbed or damaged by installation of new work using materials to match existing.

E. Apply insulation to completely cover metal surface. Surface shall be applied to present a tight, smooth appearance.

F. Exposed Piping: Locate insulation and cover seams in least visible locations.

G. For hot piping conveying fluids 140 degrees F or less, and on insulated piping without vapor barrier, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

H. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

I. Neatly finish insulation at supports, protrusions, and interruptions.

J. Do not use staples on vapor barrier insulation.

K. Jackets:

1. Indoor, Concealed Applications: Insulated pipes conveying fluids above ambient temperature shall have standard jackets, with vapor barrier, factory-applied or field-applied. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass cloth and adhesive. PVC jackets may be used.
2. Indoor, Concealed Applications: Insulated dual-temperature pipes or pipes conveying fluids below ambient temperature shall have vapor barrier jackets, factory-applied. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe, and finish with glass cloth and vapor barrier adhesive.
3. Indoor, Exposed Applications: For pipe exposed in mechanical equipment rooms or in finished spaces, insulate and jacket as for concealed applications, and finish with PVC jackets.
4. Outdoor Jackets: Insulate as per the specification and jacket with Polyguard Insul-wrap 50W Membrane. For watertight insulation jacket install as per manufacturers recommendations. Furnish all mastics and adhesives as per manufacture system.

L. Inserts and Shields:

1. Application: All insulated Piping 2 inches diameter or larger shall be installed with inserts and shields as follows.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

M. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

N Underground applications:
The internal pipe shall be hydrostatically tested to 150 psig or 1½ times the operating pressure, whichever is greater. Insulation shall then be poured in place into the field weld area. All field applied insulation shall be placed only in straight sections. Field insulation of fittings shall not be acceptable. The mold for the polyurethane shall be made of clear adhesive backed polyester film. The installer shall seal the field joint area with a heat shrinkable adhesive backed wrap or with wrappings of glass reinforcement fully saturated with a catalyzed resin identical in properties to the factory-applied resin. Backfilling shall not begin until the heat shrink wrap has cooled or until the FRP lay-up has cured. All insulation and coating materials for making the field joint shall be furnished by the piping system manufacture.

3.03 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

3.04 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

5. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
6. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
7. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Abut each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
8. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
9. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
10. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
11. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
12. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
13. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape

insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

14. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
15. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
16. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
17. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.05 INSULATION SCHEDULE

Refer to the insulation schedule below for pipe insulation thickness by system. Not all systems are necessarily included in this project.

INSULATION SCHEDULE							
SERVICE	INSULATION	TEMPERATURE	NOMINAL PIPE SIZE				
	TYPE	RANGE (F°)	<1"	1" to< 1 1/2"	1 1/2" to< 4"	4" to< 8"	≥ 8"
			INSULATION THICKNESS				
Hot Water (HW)	A	> 350°	4 1/2	5	5	5	5
		251°-350°	3	4	4	4 1/2	4 1/2
		201°-250°	2 1/2	2 1/2	2 1/2	3	3
		141°-200°	1 1/2	1 1/2	2	2	2
		105°-140°	1	1	1 1/2	1 1/2	1 1/2
Buried (HW)	C	> 350°	4 1/2	5	5	5	5
		251°-350°	3	4	4	4 1/2	4 1/2
		201°-250°	2 1/2	2 1/2	2 1/2	3	3
		141°-200°	2	2	2 1/2	2 1/2	2 1/2
		105°-140°	1 1/2	1 1/2	2	2	2
Chilled Water (CHW)	A	40°- 60°	1/2	1/2	1	1	1
		< 40°	1/2	1	1	1	1
Buried (CHW)	C	40°- 60°	1	1 1/2	1 1/2	1 1/2	1 1/2
		< 40°	1	1 1/2	1 1/2	1 1/2	1 1/2
Steam & Condensate	A	Low Pressure	2 1/2	2 1/2	2 1/2	3	3
Steam Condensate	A	Low Pressure	2 1/2	2 1/2	2 1/2	3	3
Condensate Drains	A	All	1/2	1/2	1	1	1
Cold Water Make up	A	All	1/2	1/2	1	1	1
Refrigerant Hot Gas	C	All	1 1/2	1 1/2	2	2	2
Humidifier Steam	A	All	2 1/2	2 1/2	2 1/2	3	3
Refrigerant Suction	C	All	1/2	1/2	1	1	1

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. These basic Mechanical Requirements apply to all Division 23 Sections.

B. The work of this Section consists of providing of all materials, labor and equipment and the like necessary and/or required for the complete execution of all mechanical for this project, as required by the contract documents.

1.2 Qualifications of Bidder

A. All bidders must be building automation contractors in the business of installing direct digital control building automation systems for a minimum of 5 years.

B. All bidders must have a service and installation office in the Westchester area.

C. All bidders must be authorized distributors or branch offices of the manufacturers specified.

D. All bidders must have a trained staff of application engineers, who have been certified by the manufacturer in the configuration, programming and service of the automation system.

E. Manufacturers: Subject to compliance with requirements, provide products by the following pre-qualified manufacture:
   1. Johnson Facility Explorer by Johnson Controls

1.3 Scope of Work

A. Except as otherwise noted, the control system shall consist of all Ethernet Network Controllers, Standalone Digital Control Units, software, sensors, transducers, relays, valves, dampers, valve and damper operators, control panels, and other accessory equipment, along with a complete system of electrical interlocking wiring to fill the intent of the specification and provide for a complete and operable system. Unless otherwise specified, provide operators for equipment such as dampers and valves if the equipment manufacturer does not provide these. Coordinate requirements with the mechanical contractors.

B. The Building Automation System (BAS) contractor shall review and study all HVAC drawings and the entire specification to familiarize himself with the equipment and system operation, and to verify the quantities and types of dampers, operators, alarms, controllers etc. to be provided. Review the existing temperature controls equipment installed in the building. All new temperature controls equipment shall be Schneider Electric Ecostruxure.

C. All interlocking, wiring and installation of control devices associated with the equipment listed below shall be provided under this Contract. When the BAS system is fully installed and operational, the BAS Contractor and representatives of the Owner will review and check out the system. At that time, the BAS contractor shall demonstrate the operation of the system and prove that it complies with the intent of the drawings and specifications.

D. The Contractor shall furnish and install a complete building automation system including all necessary hardware, network wiring, all operating applications software, and all programming necessary to perform the control sequences of operation as called for in the specifications. The scope of work shall include control over, and graphic representation, all new mechanical equipment installed as part of this project.

E. At a minimum, provide controls for the following:
   1. New packaged Rooftop units
   2. New air handling units
   3. All new radiant heating valves
   4. VRF split systems
   5. AC split systems
   6. Dedicated outdoor air systems (DOAS)
   7. Energy Recovery Units
   8. Fuel oil day tank
   9. Room fintube

F. New packaged roof top units, DOAS, and VRF split systems shall be supplied with the manufacturer's operating controller. Provide BACnet interface with all new equipment as required provide scheduling and reset functions and as well as the sequence of operations for all equipment as given in specific specification sections.

G. Provide services and manpower necessary for commissioning of system in coordination with the HVAC Contractor, Balancing Contractor and Owner's representative.

H. All work performed under this section of the specifications will comply with all codes, laws and governing bodies. If this specification and associated drawings exceed governing code requirements, the specification will govern. The Contractor shall obtain and pay for all necessary construction permits and licenses.

I. Provide all labor and materials to perform all programming necessary at the owners existing operator workstation located in the Elementary School. Graphically represent and control each and every piece of equipment in the lists above all input and output status points, and functional points.

1.4 System Description

A. The Building Automation System (BAS) shall consist of PC-based workstation and microcomputer controllers of modular design providing distributed processing capability and allowing future expansion of both input/output points and processing/control functions. For this project the system shall consist of the following components:

B. Operator Workstations. (Not in Scope)

The BAS Contractor shall furnish (1) Operator Workstation Computer and (1) printer as described in Part 2 of the specification. This workstation must be running the standard workstation software developed and tested by the manufacturer of the network controllers and the standalone controllers. No third-party front-end workstation software will be acceptable. Provide all necessary software and licensing as required.

C. Ethernet-based Network Controllers.

1. The BAS Contractor shall furnish Ethernet-based network controllers as described in Part 2 of the specification. These controllers will connect directly to the Operator Workstation over Ethernet, provide communication to the Standalone Digital Control Units and/or other Input/Output Modules and serve as a gateway to equipment furnished by others (if applicable).

D. Standalone Digital Control Units (SDCUs).

1. Provide the necessary quantity and types of SDCUs to meet the requirements of the project for mechanical equipment control including air handlers, control, and terminal unit

control. Each SDCU will operate completely standalone, containing all of the I/O and programs to control its associated equipment.

E. Service Tool. (Not in Scope)

1. Provide a portable service tool for monitoring and commissioning of the network and Standalone Digital Control Units. The tool shall have all the appropriate software for system access and have the same functionality as the main work station.

F. Modem. (Not in Scope)

1. A modem shall be furnished for remote interrogation of the system. The modem shall operate at a minimum of 28.8 KBaud and allow for access to the entire network of controllers.

1.5 Work by Others

A. The BAS Contractor shall cooperate with other contractors performing work on this project necessary to achieve a complete and neat installation. To that end, each contractor shall consult the drawings and specifications for all trades to determine the nature and extent of others' work.

B. The BAS Contractor shall furnish all control valves, sensor wells, flow meters and other similar equipment for installation by the Mechanical Contractor.

C. The BAS Contractor shall provide field supervision to the designated contractor for the installation of the following as required:

1. Automatic control dampers
2. Fire/smoke dampers
3. Sheet metal baffle plates to eliminate stratification.

D. The Electrical Contractor shall provide:

1. All 120v power wiring to motors, heat trace, junction boxes for power to BAS panels.
2. Smoke detectors. HVAC Contractor to mount devices. BAS Contractor to hardwire to fan shut down. BAS contractor to coordinate this with the electrical contractor.

E. The BAS Contractor shall provide:

1. BAS Contractor to hardwire to fan shut down. BAS contractor to coordinate this with the electrical contractor.

1.6 Code Compliance

A. Provide BAS components and ancillary equipment, which are UL-916 listed and labeled.

B. All equipment or piping used in conditioned air streams, spaces or return air plenums shall comply with NFPA 90A Flame/Smoke/Fuel contribution rating of 25/50/0 and all applicable building codes or requirements.

C. All wiring shall conform to the National Electrical Code.

D. All smoke dampers shall be rated in accordance with UL 555S.

E. Comply with FCC rules, Part 15 regarding Class A radiation for computing devices and low power communication equipment operating in commercial environments.

F. Comply with FCC, Part 68 rules for telephone modems and data sets.

1.7 Submittals

A. The Contractor shall furnish all submittals in PDF format. Drawings shall be B size or larger.

B. Shop drawings shall include a riser diagram depicting locations of all controllers and workstations, with associated network wiring. Also included shall be individual schematics of each mechanical system showing all connected points with reference to their associated controller. Typical will be allowed where appropriate.

C. Submittal data shall contain manufacturer's data on all hardware and software products required by the specification. Valve, damper and air flow station schedules shall indicate size, configuration, capacity and location of all equipment.

D. Software submittals shall contain narrative descriptions of sequences of operation, program listings, point lists, and a complete description of the graphics, reports, alarms and configuration to be furnished with the workstation software. All literature, descriptions, equipment spec sheets, sequences etc., shall be on 8 1/2 x 11 or larger sized sheets. All details diagrams and schematics shall be on 11X17 sized sheets or larger.

E. Submit shop drawings to the Engineer for review and approval prior to ordering or fabrication of the equipment. The Contractor prior to submitting shall check all documents for accuracy.

F. The Engineer will make corrections and return to the Contractor. The Contractor will then resubmit with the corrected or additional data. No controls submittals shall approved until all controls have fully coordinated with equipment manufactures requirements.

G. Submit a training class syllabus and training manual for review with the temperature controls submittal. The training manual shall be custom made for this project. Manufactures brochures, and installation manuals will not be acceptable for this purpose. Submit a type written overview and a written summary of each topic to be covered. The document shall be suitable for a system operator to use as a quick reference guide to basic system operation as applicable for this project. Refer to section 1.9 paragraph B, for the minimum requirement of training to be included.

1.8 System Startup & Commissioning

A. Each point in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation specified herein. Successful completion of the system test shall constitute the beginning of the warranty period. A written report will be submitted to the owner indicating that the installed system functions in accordance with the plans and specifications.

B. The BAS contractor shall commission and set in operating condition all major equipment and systems, such as the chilled water, hot water and all air handling systems, in the presence of the equipment manufacturer’s representatives, as applicable, and the Owner and Architect’s representatives.

C. The BAS Contractor shall provide all manpower and engineering services required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building. The BAS Contractor shall have a trained technician available on request during

the balancing of the systems. The BAS Contractor shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and shall include all labor and materials in his contract.

1.9 Training

A. The BAS Contractor shall provide both on-site training to the Owner's representative and maintenance personnel per the following description:

B. On-site training shall consist of a minimum of (2) separate 2-hour sessions of hands-on instruction geared at the operation and maintenance of the systems. The sessions shall be scheduled at the beginning of substantial completion and spaced out over the first year of owner use. The first session curriculum shall include.

1. System Overview
2. System Software and Operation

    a. System access
    b. Software features overview
    c. Changing set-points and other attributes
    d. Scheduling
    e. Editing programmed variables
    f. Displaying color graphics
    g. Running reports
    h. Workstation maintenance
    i. Application programming

3. Operational sequences including start-up, shutdown, adjusting and changing system variables. These items shall be reviewed for all equipment installed under this project and or connected to the BMS under this project.
4. Equipment and hardware overview and maintenance. This shall include:

    a. Review of all hardware installed under this project.
    b. Review of a system schematic.
    c. Review of where each controller is located in the building and what its function is. This shall include a walking, hands-on tour and demonstration of each and every controller.

1.10 Operating and Maintenance Manuals

A. The operation and maintenance manuals shall contain all information necessary for the operation, maintenance, replacement, installation, and parts procurement for the entire BAS. This documentation shall include specific part numbers and software versions and dates. A complete list of recommended spare parts shall be included with the lead-time and expected frequency of use of each part clearly identified.

B. Following project completion and testing, the BAS contractor will submit as-built drawings reflecting the exact installation of the system. The as-built documentation shall also include a copy of all application software both in written form and on diskette.

1.11 Warranty

A. The BAS contractor shall warrant the system for 12 months after system acceptance and beneficial use by the owner. During the warranty period, the BAS contractor shall be responsible for all necessary revisions to the software as required to provide a complete and workable system consistent with the letter and intent of the Sequence of Operation section of the specification.

B. Updates to the manufacturer's software shall be provided at no charge during the warranty period.

1.12 Programming

A. Sequence of operations: The controls contractor shall review the sequences of operation given in section 23 09 93 of this specification. "Canned", preprogrammed, or typical sequences by the manufacturer may not be acceptable and shall only be used if accepted by the engineer. Otherwise, the controls contractor shall be capable of and responsible for providing custom programming, hardware, software, and labor as required to achieve the sequences of operation as specified.

PART 2 - SYSTEM ARCHITECTURE

2.1 General

A. The Building Automation System (BAS) shall consist of all new Network Control Units (NCUs), a family of Standalone Digital Control Units (SDCUs), Input/Output Unit Modules (IOU Modules), Operator Workstations (OWs), and one File Server to support system configurations where more than one operator workstation is required. The BAS shall provide control, alarm detection, scheduling, reporting and information management for the entire classroom building and all new and existing equipment in the building, and Wide Area Network (WAN) if applicable, from a single ODBC-compliant database.

B. Level 1 Network Description

C. Level 1, the main backbone of the system, shall be an Ethernet LAN/WAN. Network Control Units, Operator Workstations, and the Central File Server shall connect directly to this network without the need for Gateway devices. The contractor shall visit the site and review the existing Andover temperature controls equipment installed in the building and in the physical plant. Certain of these controllers may be suitable for reuse. The network shall be an extension of the existing in the building as required to achieve a complete system,

D. Level 2 Network Description

E. Level 2 of the system shall consist of one or more field buses managed by the Network Control Units. The Level 2 field buses may consist of one or both of the following types:

F. An RS485, token passing bus that supports up to 127 Standalone Digital Control Units (SDCUs) for operation of HVAC equipment and lighting, or

G. An RS485 field bus that supports up to 32 devices from a family of plug-in, IOU modules.

H. These IOU modules may be mounted within the NCU enclosure or remotely mounted via a single, twisted, shielded pair of wires.

I. The BAS shall be capable of being segmented, through software, into multiple local area networks (LANs) distributed over a wide area network (WAN), sharing a single file server. This enables workstations to manage a single LAN (or building), and/or the entire system with all devices being assured of being updated by and sharing the most current database. In the case of a single workstation system, the workstation shall contain the entire database – with no need for a separate file server.

J. Standard Network Support

K. All NCUs, Workstation(s) and File Server shall be capable of residing directly on the owner's Ethernet TCP/IP LAN/WAN with no required gateways. Furthermore, the NCU's, Workstation(s) and File Server shall be capable of using standard, commercially available, off-the-shelf Ethernet infrastructure components such as routers, switches and hubs. With this design the owner may utilize the investment of an existing or new enterprise network or structured cabling system. This also allows the option of the maintenance of the LAN/WAN to be performed by the owner's Information Systems Department as all devices utilize standard TCP/IP components.

L. Remote Communications

M. In addition to the above LAN/WAN architecture support, the same workstation software (front end) must be capable of managing remote systems via standard dial-up phone lines as a standard component of the software. Front-end "add-on" software modules to perform remote site communication shall not be acceptable.

N. The remote system architecture shall consist of two levels providing control, alarm detection, reporting and information management for the remote facility. Level 1 shall contain the Remote Site Control Unit, communicating to the remotely located, Operator Workstation(s) through the use of a modem and a standard dial-up phone line. Level 2 shall consist of one or more field buses controlled by the RSCU. The field buses may consist of one or both of two types:

O. 1) An RS485, token passing bus that supports up to 127 Standalone Digital Control Units (SDCUs) for operation of HVAC equipment and lighting, or

P. 2) An RS485 field bus that supports up to 32 devices from a family of plug-in, IOU modules that may be mounted within the RSCU enclosure or remotely mounted on a single, twisted, shielded pair of wires.

Q. System Expansion

R. The BAS system shall be scalable and expandable at all levels of the system using the same software interface, and the same Level 1 and Level 2 controllers. Systems that require replacement of either the workstation software or field controllers in order to expand the system shall not be acceptable.

S. The BAS shall be expandable to include Security and Access Control functions at any time in the future with no additional workstations, front-end software or Level 1 controllers required. Standalone Digital Control Units or IOU modules shall be able to be added to the existing Level 1 controller's field bus(es), to perform security and card access applications. In this way, an owner's existing investment in wiring infrastructure may be leveraged and the cost and inconvenience of adding new field bus wiring will be minimized.

T. Additionally, an integrated video badging option must be able to be included with no additional workstations required. This photo ID option must share the same database as the BAS in order to eliminate the need for updating multiple databases.

U. The system shall use the same application programming language for all levels: Operator Workstation, Network Control Unit, Remote Site Control Unit and Standalone Digital Control Unit. Furthermore, this single programming language shall be used for all applications: environmental control, card access control, intrusion detection and security, lighting control, leak detection / underground storage tank monitoring, and digital data communication interfaces to third party microprocessor-based devices.

V. Support For Open Systems Protocols

The BAS design must include solutions for the integration of the following “open systems” protocols: BACnet, LonTalk™, and digital data communication to third party microprocessors such as chiller controllers, fire panels and variable frequency drives (VFDs).

W. The system shall also provide the ability to program custom ASCII communication drivers, that will reside in the NCU, for communication to third party systems and devices. These drivers will provide real-time monitoring and control of the third-party systems.

2.2 Network Control Units (NCUs)

A. Network Control Units shall be microprocessor based, multi-tasking, multi-user, and employ a real-time operating system. Each NCU control panel shall consist of modular hardware including power supply, CPU board, and input/output modules. A sufficient number of NCUs shall be supplied to fully meet the requirements of this specification and the attached point list. NCU’s for telephone dialup sites shall be of the same design as the Ethernet control units but without the plug-in Ethernet network interface card (NIC), i.e., NCUs, which include a NIC, shall be interchangeable whether used on a LAN/WAN or a dialup site.

B. Webserver Functionality

All NCUs on the Ethernet TCP/IP LAN/WAN shall be capable, out-of-the box, to be set up as a Web Server. The NCU shall have the ability to store HTML code and “serve” pages to a web browser. This provides the ability for any computing device utilizing a TCP/IP Ethernet connection and capable of running a standard Internet browser (Microsoft Internet Explorer™, Netscape Navigator™, etc.) to access real-time data from the entire BAS via any NCUs.

Graphics and text-based web pages shall be constructed using standard HTML code. The interface shall allow the user to choose any of the standard text or graphics-based HTML editors for page creation. It shall also allow the operator to generate custom graphical pages and forms.

The WEB server interface shall be capable of password security, including validation of the requesting PC’s IP address. The WEB server interface shall allow the sharing of data or information between any controller, or process or network interface (BACnet, LonTalk and TCP/IP) that the BMS has knowledge of, regardless of where the point is connected on the BAS network or where it is acquired from.

The BAS network controller must act directly as the WEB server. It must directly generate the HTML code to the requesting user (i.e. WEB browser), eliminating the need for and reliance on any PC-based WEB server hardware or software. To simplify graphic image space allocation, HTML graphic images, if desired, shall be stored on any shared network device. The BAS WEB server shall have the ability to acquire any necessary graphics using standard pathing syntax within the HTML code mounted within the BAS WEB server. External WEB server hardware and software are not acceptable.

C. Hardware Specifications

1. Memory:

   A minimum of 64MB of RAM shall be provided for NCUs with expansion up to 128 MB. The 64 MB versions shall include a floating-point math co-processor.

2. Communication Ports:

   Each NCU shall provide communication to both the Workstation(s) and the field buses. In addition, each NCU must have at least 3 other communications ports that support a telephone modem, portable service tool, serial printer and connection to third party controllers such as a chiller control panel. On a LAN/WAN system the NCU shall be provided with a 10Mbps plug-in Ethernet TCP/IP network interface card (NIC).

3. Input/Output (I/O):

   Each NCU shall support the addition of the following types of inputs and outputs:

- Digital Inputs for status/alarm contacts
- Counter Inputs for summing pulses from meters.
- Thermistor inputs for measuring temperatures in space, ducts and thermowells.
- Analog inputs for pressure, humidity, flow and position measurements.
- Digital Outputs for on/off equipment control.
- Analog Outputs for valve and damper position control, and capacity control of primary equipment including all air handler and fan coil control valves.

4. Modular Expandability:

   The system shall employ a modular I/O design to allow easy expansion. Input and output capacity is to be provided through plug-in modules of various types or DIN-mountable IOU modules. It shall be possible to combine I/O modules as desired to meet the I/O requirements for individual control applications.

5. Hardware Override Switches:

   All digital output units shall include three position manual override switches to allow selection of the ON, OFF, or AUTO output state. These switches shall be built into the unit and shall provide feedback to the controller so that the position of the override switch can be obtained through software. In addition, each analog output shall be equipped with an override potentiometer to allow manual adjustment of the analog output signal over its full range, when the 3 position manual override switch is placed in the ON position.

6. Local Status Indicator Lamps:

   Provide as a minimum LED indication of CPU status, Ethernet LAN status, and field bus status. For each output, provide LED indication of the value of the output (On/Off). For each output module provide an LED which gives a visual indication of whether any outputs on the module are manually overridden.

7. Real Time Clock (RTC):

   Each NCU shall include a battery-backed, real-time clock, accurate to 10 seconds per day. The RTC shall provide the following: time of day, day, month, year, and day of week. In normal operation the system clock will be based on the frequency of the AC power. The system shall automatically correct for daylight savings time and leap years and be Year 2000 compliant.

8. Power Supply:

   The power supply for the NCUs shall be auto sensing, 120-220VAC, 60/50 Hz power, with a tolerance of +/- 20%. Line voltage below the operating range of the system shall be considered outages. The controller shall contain over voltage surge protection and require no additional AC power signal conditioning. Optionally, if indicated on the drawings, the power supply shall accept an input voltage of (–48 VDC).

9. Automatic Restart After Power Failure:

   Upon restoration of power after an outage, the ECU shall automatically and without human intervention: update all monitored functions; resume operation based on current, synchronized time and status, and implement special start-up strategies as required.

10. Battery backup:

    Each NCU with the standard 120-220VAC power supply shall include a programmable DC power backup system rated for a minimum of 72 hours of battery backup to maintain all volatile memory or, a minimum of 2 hours of full UPS including modem power. This power backup system shall be configurable such that at the end of a settable timeframe (such as 1 hour) of running on full UPS, the unit will shut off full UPS and switch to memory retention-only mode for the remainder of the battery power. The system shall allow the simple addition of more batteries to extend the above minimum battery backup times.

D. Software Specifications

1. General.

   The NCU shall contain flash ROM as the resident operating system. Application software will be RAM resident. Application software will only be limited by the amount of RAM memory. There will be no restrictions placed on the type of application programs in the system. Each NCU shall be capable of parallel processing, executing all control programs simultaneously. Any program may affect the operation of any other program. Each program shall have the full access of all I/O facilities of the processor. This execution of control function shall not be interrupted due to normal user communications including interrogation, program entry, printout of the program for storage, etc.

2. User Programming Language:
   The application software shall be user programmable. This includes all strategies, sequences of operation, control algorithms, parameters, and setpoints. The source program shall be English language-based and programmable by the user. The language shall be structured to allow for the easy configuration of control programs, schedules, alarms, reports, telecommunications, local displays, mathematical calculations, passwords, and histories. The language shall be self-documenting. Users shall be able to place comments anywhere in the body of a program. Program listings shall be configurable by the user in logical groupings.

E. Control Software:

1. The NCU shall have the ability to perform the following pre-tested control algorithms:

   a. Proportional, Integral plus Derivative Control (PID)
   b. Self-Tuning PID
   c. Two Position Control
   d. Digital Filter
   e. Ratio Calculator
   f. Equipment Cycling Protection

2. Mathematical Functions:

   a. Each controller shall be capable of performing basic mathematical functions (+, -, *, /), squares, square roots, exponential, logarithms, Boolean logic statements, or combinations of both. The controllers shall be capable of performing complex logical statements including operators such as >, <, =, and, or, exclusive or, etc. These must be able to be used in the same equations with the mathematical operators and nested up to five parentheses deep.

3. Energy Management Applications:

   a. NCUs shall have the ability to perform any or all of the following energy management routines:
   b. Time of Day Scheduling
   c. Calendar Based Scheduling
   d. Holiday Scheduling
   e. Temporary Schedule Overrides
   f. Optimal Start
   g. Optimal Stop
   h. Night Setback Control
   i. Enthalpy Switchover (Economizer)
   j. Peak Demand Limiting
   k. Temperature Compensated Duty Cycling
   l. CFM Tracking
   m. Heating/Cooling Interlock

n. Supply air temp Reset

4. History Logging:
   a. Each controller shall be capable of logging any system variable over user defined time intervals ranging from 1 second to 1440 minutes. Any system variables (inputs, outputs, math calculations, flags, etc.) can be logged in history. A maximum of 32767 values can be stored in each log. Each log can record either the instantaneous, average, minimum or maximum value of the point. Logs can be automatic or manual. Logged data shall be downloadable to the Operator Workstation for long term archiving based upon user-defined time intervals, or manual command.

5. Alarm Management:

   a. For each system point, alarms can be created based on high/low limits or conditional expressions. All alarms will be tested on each scan of the NCU and can result in the display of one or more alarm messages or reports. Up to 8 alarms can be configured for each point in the controller. Messages and reports can be sent to a local terminal, to the front-end workstation(s), or via modem to a remote-computing device. Alarms will be generated based on their priority. A minimum of 255 priority levels shall be provided. If communication with the Operator Workstation is temporarily interrupted, the alarm will be buffered in the NCU. When communications return, the alarm will be transmitted to the Operator Workstation if the point is still in the alarm condition.

6. Reporting.

   a. The NCU shall be able to generate user-definable reports to a locally connected printer or terminal. The reports shall contain any combination of text and system variables. Report templates shall be able to be created by users in a word processing environment. Reports can be displayed based on any logical condition or through a user command.

2.3 Standalone Digital Control Units (SDCUs)

A. General:

1. Standalone Digital Control Units shall provide control of HVAC and lighting. Each controller shall have its own control programs and will continue to operate in the event of a failure or communication loss to its associated NCU.

B. Memory:
1. Control programs shall be stored in battery backed-up RAM and EPROM. Each controller shall have a minimum of 32K bytes of user RAM memory and 128K bytes of EPROM.

C. Communication Ports:

1. SDCUs shall provide a communication port to the field bus. In addition, a port shall be provided for connection of a portable service tool to support local commissioning and parameter changes with or without the NCU online. It shall be possible from a service port on any SDCU to view, enable/disable, and modify values of any point or program on any controller on the local field bus, any NCU or any SDCU on a different field bus.

D. Input/Output:

1. Each SDCU shall support the addition of the following types of inputs and outputs:

    a. Digital Inputs for status/alarm contacts
    b. Counter Inputs for summing pulses from meters.
    c. Thermistor Inputs for measuring temperatures in space, ducts and thermowells.
    d. Analog inputs for pressure, humidity, flow and position measurements.
    e. Digital Outputs for on/off equipment control.
    f. Analog Outputs for valve and damper position control, and capacity control of primary equipment.

E. Expandability:

1. Input and output capacity shall be expandable through the use of plug-in modules. A minimum of two modules shall be added to the base SDCU before additional power is required.

F. Networking:

1. Each SDCU will be able to exchange information on a peer-to-peer basis with other Standalone Digital Control Units during each field bus scan. Each SDCU shall be capable of storing and referencing global variables (on the LAN) with or without any workstations online. Each SDCU shall be able to have its program viewed and/or enabled/disabled either locally through a portable service tool or through a workstation connected to an NCU.

G. Indicator Lamps:

1. SDCUs will have as a minimum, LED indication of CPU status, and field bus status.

H. Real Time Clock (RTC):

1. An SDCU shall have a real time clock in either hardware or software. The accuracy shall be within 10 seconds per day. The RTC shall provide the following information: time of day, day, month, year, and day of week. Each SDCU shall receive a signal, every hour, over the network from the NCU which synchronizes all SDCU real time clocks.

I. Automatic Restart After Power Failure:

1. Upon restoration of power, the SDCU shall automatically and without human intervention, update all monitored functions, resume operation based on current, synchronized time and status, and implement special start-up strategies as required.

J. Battery Back Up:

1. Each SDCU shall have at least 3 years of battery back up to maintain all volatile memory.

K. Alarm Management:

1. For each system point, alarms can be created based on high/low limits or conditional expressions. All alarms will be tested on each scan of the SDCU and can result in the display of one or more alarm messages or reports. Up to 8 alarms can be configured for each point in the controller enabling the escalation of the alarm priority (urgency) based upon which alarm(s) is/are triggered. Alarm messages can be sent to a local terminal or

modem connected to an NCU or to the Operator's Workstation(s). Alarms will be generated based on their priority. A minimum of 255 priority levels shall be provided. If communication with the NCU is temporarily interrupted, the alarm will be buffered in the SDCU. When communications return, the alarm will be transmitted to the NCU if the point is still in the alarm condition.

L. Air Handler Controllers

1. AHU Controllers shall be capable of meeting the requirements of the sequence of operation found in the Execution portion of this specification and for future expansion.
2. AHU Controllers shall support all the necessary point inputs and outputs as required by the sequence and operate in a standalone fashion.
3. AHU Controllers shall be fully user programmable to allow for modification of the application software.
4. An LCD display shall be optionally available for readout of point values and to allow operators to change setpoints and system parameters.
5. A manual override switch shall be provided for all digital and analog outputs on the AHU Controller. The position of the switch shall be monitored in software and available for operator displays and alarm notification.

M. VAV Terminal Unit Controllers (Not Used)

1. VAV Terminal Unit Controllers shall support, but not be limited to the control of the following configurations of VAV boxes to address current requirements as described in the Execution portion of this specification, and for future expansion:

   a. Single Duct Cooling Only
   b. Single Duct Cooling with Reheat (Electric or Hot Water)
   c. Fan Powered (Parallel or Series)
   d. Dual Duct (Constant or Variable Volume)
   e. Supply/Exhaust

2. VAV Controllers for single duct applications will come equipped with a built-in actuator for modulation of the air damper. The actuator shall have a minimum torque rating of 35 in.-lb. and contain an override mechanism for manual positioning of the damper during startup and service. VAV Controllers shall contain an integral velocity sensor accurate to +/- 5% of the full range of the box's CFM rating. Each controller shall perform the sequence of operation described in Part 3 of this specification, and have the capability for time-of-day scheduling, occupancy mode control, after hours operation, lighting control, alarming, and trending. VAV Controllers shall be able to communicate with any other Standalone Digital Control Unit on the same field bus with or without communication to the NCU managing the field bus. Systems that fail to provide this (true peer-to-peer) capability will be limited to a maximum of 32 VAV controllers per field bus.

3. Unitary Controllers

   a. Unitary Controllers shall support, but not be limited to, the control of the following systems as described in the Execution portion of this specification, and for future expansion:

      1) Cabinet heater and convectors
      2) Rooftop top air handling units
      3) Fan Coils
      4) Unit and cabinet heaters

b. The I/O of each Unitary Controller shall contain the sufficient quantity and types as required to meet the sequence of operation found in the Execution portion of this specification. In addition, each controller shall have the capability for time-of-day scheduling, occupancy mode control, after-hours operation, lighting control, alarming, and trending.

N. Display Controllers (Not used)

1. Display controllers are standalone, touch screen-based operator interfaces. The controller shall be designed for flush mounting in a finished space, with a minimum display size of 9 x 9 inches. Software shall be user programmable allowing for custom graphical images that simulate floor plans, menus, equipment schematics along with associated real time point values coming from any NCU on the network. The touch screen display shall contain a minimum of 64 possible touch cells that permit user interaction for changing screens, modifying set-points or operating equipment. Systems that do not offer a display controller as specified must provide a panel mounted computer with touch screen capability as an alternative. All air handling units shall use display controllers.

2.4 Operator Workstation Requirements

A. The building Andover system has an existing operator workstation that shall be reused.

2.5 Portable Operator's Terminal (NOT USED)

2.6 DDC Sensors and Point Hardware

A. Temperature Sensors

1. All temperature devices shall use precision thermistors accurate to +/- 1 degree F over a range of –30 to 230 degrees F. Space temperature sensors shall be accurate to +/- .5 degrees F over a range of 40 to 100 degrees F.

2. Space sensors shall have off white enclosure and shall be mounted on a standard electrical box. Space sensors shall use surface mounted finished cast electrical box for surface mounting with metal "wire-mold" to conceal wiring for all solid masonry partitions. For space sensors located on gypsum board partitions, wiring shall be concealed inside the walls with recessed flush mounted electrical boxes. In general, control wiring shall run from the ceiling plenum to the box which shall be wall mounted next to the door or as shown on plan. (This shall be the standard for this project)

3. The space sensor housing shall utilize buttons for adjusting the space temperature set-point, as well as a push button for selecting after hours operation, fan speed and all other operator selectable parameters. Operators shall be able to adjust set points directly from the sensor. All space sensors, (located in public location, office, classrooms), shall incorporate either an LED or LCD display for viewing the space temperature, set-point and other operator selectable parameters. Space sensors located in store rooms, MER, and unoccupied space are not required have LED or LCD display.

4. Duct temperature sensors shall incorporate a thermistor bead embedded at the tip of a stainless steel tube. Probe style duct sensors are useable in air handling applications where the coil or duct area is less than 14 square feet.

5. Averaging sensors shall be employed in ducts which are larger than 14 square feet. The averaging sensor tube must contain at least one thermistor for every 3 feet, with a minimum tube length of 12 feet.
6. Immersion sensors shall be employed for measurement of temperature in all chilled and hot water applications as well as refrigerant applications. Thermal wells shall be brass or stainless steel for non-corrosive fluids below 250 degrees F and 300 series stainless steel for all other applications.
7. A pneumatic signal shall not be allowed for sensing temperature.

B. Humidity Sensors

1. Humidity devices shall be accurate to +/- 5% at full scale for space and +/- 3% for duct and outside air applications. Suppliers shall be able to demonstrate that accuracy is NIST traceable.
2. Provide a handheld field calibration tool that both reads the output of the sensor and contains a reference sensor for ongoing calibration.

C. Pressure Sensors

1. Air pressure measurements in the range of 0 to 10” water column will be accurate to +/- 1% using a solid-state sensing element. Acceptable manufacturers include Modus Instruments and Mamac.
2. Differential pressure measurements of liquids or gases shall be accurate to =/- 0.5% of range. The housing shall be Nema 4 rated.

D. Current and KW Sensors

1. Current status switches shall be used to monitor fans, pumps, motors and electrical loads. Current switches shall be available in solid and split core models, and offer either a digital or an analog signal to the automation system. Acceptable manufacturer is Veris or approved equal.
2. Measurement of three phase power shall be accomplished with a kW/kWH transducer. This device shall utilize direct current transformer inputs to calculate the instantaneous value (kW) and a pulsed output proportional to the energy usage (kWH). Provide Veris Model 6000 Power Transducer or approved equal.

E. Flow Sensors

1. Provide an insertion vortex flowmeter for measurement of liquid, gas or steam flows in pipe sizes above 3 inches.
2. Install the flow meter on an isolation valve to permit removal without process shutdown.
3. Sensors shall be manufactured by EMCO or approved equal.

F. Electric/Pneumatic Transducers

1. Electric to pneumatic transducers shall operate from either a PWM or analog signal. E/P transducers shall be rated for 0 - 20 psi operation and accurate to 2% of full scale. E/P transducers shall have a maximum air consumption of 100 SCIM.
2. E/P transducers may be installed at the end device (damper or valve), or mounted separately in a field interface panel, or as part of the controller. All transducers will be calibrated. Panel mounted transducers shall be Sensycon or approved equal.

G. Electric/Pneumatic Solenoid Valves

Electric solenoid operated pneumatic valves (EP's) shall have a three-port operation: common, normally open and normally closed. They shall be rated for 50 psig when used for 25 psig or

less applications, or rated for 150 psig when used for 100 psig or less applications. The coils shall be equipped with transient suppression devices to limit transients to 150 percent of the rated coil voltage.

2.7 Control Valves

A. Provide automatic control valves suitable for the specified controlled media (steam, water or glycol). Provide valves which mate and match the material of the connected piping. Equip control valves with the actuators of required input power type and control signal type to accurately position the flow control element and provide sufficient force to achieve required leakage specification.

B. Control valves shall meet the heating and cooling loads specified, and close off against the differential pressure conditions within the application. Valves should be sized to operate accurately and with stability from 10 to 100% of the maximum design flow.

C. Trim material shall be stainless steel for steam and high differential pressure applications.

D. Electric actuation should be provided on all terminal unit reheat applications.

2.8 Dampers

A. Automatic dampers, furnished by the Building Automation Contractor shall be single or multiple blade as required. Dampers are to be installed by the HVAC Contractor under the supervision of the BAS Contractor. All blank-off plates and conversions necessary to install smaller than duct size dampers are the responsibility of the Sheet Metal Contractor.

B. Damper frames are to be constructed of 13-gauge galvanized sheet steel mechanically joined with linkage concealed in the side channel to eliminate noise as friction. Compressible spring stainless steel side seals, and acetal or bronze bearings shall also be provided.

C. Damper blade width shall not exceed eight inches. Seals and 3/8-inch square steel zinc plated pins are required. Blade rotation is to be parallel or opposed as shown on the schedules.

D. For high performance applications, control dampers will meet or exceed the UL Class I leakage rating.

E. Control and smoke dampers shall be Ruskin, or approved equal.

F. Provide opposed blade dampers for modulating applications and parallel blade for two position control.

2.9 Damper Actuators

A. Electronic Actuators – the actuator shall be direct coupled over the shaft, enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator shall have electronic overload circuitry to prevent damage. For power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing. Non-spring return actuators shall have an external manual gear release to allow positioning of the damper when the actuator is not powered.

2.10 Smoke Detectors

A. Air duct smoke detectors shall be by Air Products & Controls or approved equal. The detectors shall operate at air velocities from 300 feet per minute to 4000 feet per minute.

B. The smoke detector shall utilize a photoelectric detector head.

C. The housing shall permit mechanical installation without removal of the detector cover.

D. The detectors shall be listed by Underwriters Laboratories and meet the requirements of UL 268A.

2.11 Airflow Measuring Stations

A. Provide a thermal anemometer using instrument grade self-heated thermistor sensors with thermistor temperature sensors.

B. The flow station shall operate over a range of 0 to 5,000 feet/min with an accuracy of +/- 2% over 500 feet/min and +/- 10 ft/min for reading less than 500 feet/min.

C. The output signal shall be linear with field selectable ranges including 0-5 VDC, 0-10VDC and 4-20 mA.

D. Furnish Ebtron Series 3000 airflow stations or approved equal.

PART 3 - EXECUTION

3.1 Contractor Responsibilities

A. General

Installation of the building automation system shall be performed by the Contractor or a subcontractor. However, all installation shall be under the personal supervision of the Contractor. The Contractor shall certify all work as proper and complete. Under no circumstances shall the design, scheduling, coordination, programming, training, and warranty requirements for the project be delegated to a subcontractor.

B. Demolition

1. Remove controls which do not remain as part of the building automation system, all associated abandoned wiring and conduit, and all associated pneumatic tubing and or wiring. The Owner will inform the Contractor of any equipment which is to be removed that will remain the property of the Owner. All other equipment which is removed will be disposed of by the Contractor.

C. Access to Site

1. Unless notified otherwise, entrance to the building is restricted. No one will be permitted to enter the building unless their names have been cleared with the Owner or the Owner’s Representative.

D. Code Compliance

1. All wiring shall be installed in accordance with all applicable electrical codes and will comply with equipment manufacturer's recommendations. Should any discrepancy be found between wiring specifications in Division 17 and Division 16, wiring requirements of Division 17 will prevail for work specified in Division 17.

E. Cleanup

1. At the completion of the work, all equipment pertinent to this contract shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this contract.

3.2 Wiring, Conduit, and Cable

A. All wire will be copper and meet the minimum wire size and insulation class listed below:

Wire Class	Wire Size	Isolation Class
Power	12 Gauge	600 Volt
Class One	14 Gauge Std.	600 Volt
Class Two	18 Gauge Std.	300 Volt
Class Three	18 Gauge Std.	300 volt
Communications	Per Mfr.	Per Mfr.

B. Power and Class One wiring may be run in the same conduit. Class Two and Three wiring and communications wiring may be run in the same conduit.

C. Where different wiring classes terminate within the same enclosure, maintain clearances and install barriers per the National Electric Code.

D. Where wiring is required to be installed in conduit, EMT shall be used. Conduit shall be minimum 1/2 inch galvanized EMT. Set screw fittings are acceptable for dry interior locations. Watertight compression fittings shall be used for exterior locations and interior locations subject to moisture. Provide conduit seal off fitting where exterior conduits enter the building or between areas of high temperature/moisture differential.

E. Flexible metallic conduit (max. 3 feet) shall be used for connections to motors, actuators, controllers, and sensors mounted on vibration producing equipment. Liquid-tight flexible conduit shall be use in exterior locations and interior locations subject to moisture.

F. Junction boxes shall be provided at all cable splices, equipment termination, and transitions from EMT to flexible conduit. Interior dry location J-boxes shall be galvanized pressed steel, nominal four-inch square with blank cover. Exterior and damp location JH-boxes shall be cast alloy FS boxes with threaded hubs and gasketed covers.

G. Where the space above the ceiling is a supply or return air plenum, the wiring shall be plenum rated. Teflon wiring can be run without conduit above suspended ceilings. EXCEPTION: Any wire run in suspended ceilings that is used to control outside air dampers or to connect the system to the fire management system shall be in conduit.

H. Coaxial cable shall conform to RG62 or RG59 rating. Provide plenum rated coaxial cable when running in return air plenums.

I. Fiber optic cable shall include the following sizes; 50/125, 62.5/125 or 100/140.

J. Only glass fiber is acceptable, no plastic.

K. Fiber optic cable shall only be installed and terminated by an experienced contractor. The BAS contractor shall submit to the Engineer the name of the intended contractor of the fiber optic cable with his submittal documents.

L. Hardware Installation

3.3 Installation Practices for Wiring

A. All controllers are to be mounted vertically and per the manufacturer's installation documentation.

B. The 120VAC power wiring to each Ethernet or Remote Site controller shall be a dedicated run, with a separate breaker. Each run will include a separate hot, neutral and ground wire. The ground wire will terminate at the breaker panel ground. This circuit will not feed any other circuit or device.

C. A true earth ground must be available in the building. Do not use a corroded or galvanized pipe, or structural steel.

D. Wires are to be attached to the building proper at regular intervals such that wiring does not droop. Wires are not to be affixed to or supported by pipes, conduit, etc.

E. Conduit in finished areas will be concealed in ceiling cavity spaces, plenums, furred spaces and wall construction. Exception: metallic surface raceway may be used in finished areas on masonry walls. All surface raceway in finished areas must be color matched to the existing finish within the limitations of standard manufactured colors.

F. Conduit, in non-finished areas where possible, will be concealed in ceiling cavity spaces, plenums, furred spaces, and wall construction. Exposed conduit will run parallel to or at right angles to the building structure.

G. Wires are to be kept a minimum of three (3) inches from hot water, steam, or condensate piping.

H. Where sensor wires leave the conduit system, they are to be protected by a plastic insert.

I. Wire will not be allowed to run across telephone equipment areas.

3.4 Installation Practices for Field Devices

A. Well-mounted sensors will include thermal conducting compound within the well to insure good heat transfer to the sensor.

B. Actuators will be firmly mounted to give positive movement and linkage will be adjusted to give smooth continuous movement throughout 100 percent of the stroke.

C. Relay outputs will include transient suppression across all coils. Suppression devices shall limit transients to 150% of the rated coil voltage.

D. Water line mounted sensors shall be removable without shutting down the system in which they are installed.

E. For duct static pressure sensors, the high-pressure port shall be connected to a metal static pressure probe inserted into the duct pointing upstream. The low-pressure port shall be left open to the plenum area at the point that the high-pressure port is tapped into the ductwork.

F. For building static pressure sensors, the high-pressure port shall be inserted into the space via a metal tube. Pipe the low-pressure port to the outside of the building.

3.5 Enclosures

A. For all I/O requiring field interface devices, these devices where practical will be mounted in a field interface panel (FIP). The Contractor shall provide an enclosure which protects the device(s) from dust, moisture, conceals integral wiring and moving parts.

B. FIPs shall contain power supplies for sensors, interface relays and contactors, safety circuits, and I/P transducers.

C. The FIP enclosure shall be of steel construction with baked enamel finish, NEMA 1 rated with a hinged door and keyed lock. The enclosure will be sized for twenty percent spare mounting space. All locks will be keyed identically.

D. All wiring to and from the FIP will be to screw type terminals. Analog or communications wiring may use the FIP as a raceway without terminating. The use of wire nuts within the FIP is prohibited.

E. All outside mounted enclosures shall meet the NEMA-4 rating.

F. The wiring within all enclosures shall be run in plastic track. Wiring within controllers shall be wrapped and secured.

3.6 Identification

A. Identify all control wires with labeling tape or sleeves using either words, letters, or numbers that can be exactly cross-referenced with as-built drawings.

B. All field enclosures, other than controllers, shall be identified with a bakelite nameplate. The lettering shall be in white against a black or blue background.

C. Junction box covers will be marked to indicate that they are a part of the BAS system.

D. All I/O field devices (except space sensors) that are not mounted within FIP's shall be identified with name plates.

E. All I/O field devices inside FIP's shall be labeled.

3.7 Existing Controls.

A. Existing controls which are to be reused must each be tested and calibrated for proper operation. Existing controls which are to be reused and are found to be defective requiring replacement, will be noted to the Owner.

B. All existing controllers, thermostats, pneumatic tubing, actuators, panels gauges and any device associated with equipment is to be removed completely. Remove pneumatic lines back to wall or floor and cap airtight.

3.8 Control System Switch-over

A. Demolition of the existing control system will occur after the new temperature control system is in place including new sensors and new field interface devices.

B. Switch-over from the existing control system to the new system will be fully coordinated with the Owner. A representative of the Owner will be on site during switch-over.

C. The Contractor shall minimize control system downtime during switch-over. Sufficient installation mechanics will be on site so that the entire switchover can be accomplished in a reasonable time frame.

3.9 Location

A. The location of sensors is per mechanical and architectural drawings.

B. Space humidity or temperature sensors will be mounted away from machinery generating heat, direct light and diffuser air streams.

C. Outdoor air sensors will be mounted on the north building face directly in the outside air. Install these sensors such that the effects of heat radiated from the building or sunlight is minimized.

D. Field enclosures shall be located immediately adjacent to the controller panel(s) to which it is being interfaced.

3.10 Software Installation

A. General.

The Contractor shall provide all labor necessary to install, initialize, start-up and debug all system software as described in this section. This includes any operating system software or other third-party software necessary for successful operation of the system.

B. Database Configuration.

The Contractor will provide all labor to configure those portions of the database that are required by the points list and sequence of operation.

C. Color Graphic Slides.

Unless otherwise directed by the owner, the Contractor will provide color graphic displays as depicted in the mechanical drawings for each system and floor plan. For each system or floor plan, the display shall contain the associated points identified in the point list and allow for setpoint changes as required by the owner. Graphically represent each and every piece of equipment in the classroom building, new and existing, all input and put status point, and functional points. This shall include all new HVAC equipment.

D. Reports.

The Contractor will configure the following trend data reports for the owner.

1. Packaged roof top units
    a. Unit operating status.
    b. SA temp and set point
    c. SA static pressure and set point
    d. Room temps and set point.
    e. VAV box status / position.
    f. OA temp and set point
    g. RA temp and set point
    h. General fault alarm
2. DOAS Units
    a. Unit operating status.
    b. SA temp and set point
    c. SA static pressure and set point
    d. Room temps and set point.
    e. OA temp and set point

f. RA temp and set point
g. General fault alarm

3. VRF Systems
   a. Unit operating status.
   b. Room temps and set point.
   c. Heating / cooling mode status
   d. Fan status
   e. General fault alarms

E. Commissioning and System Startup

F. Point to Point Checkout.

Each I/O device (both field mounted as well as those located in FIPs) shall be inspected and verified for proper installation and functionality. A checkout sheet itemizing each device shall be filled out, dated and approved by the Project Manager for submission to the owner or owner's representative.

G. Controller and Workstation Checkout.

A field checkout of all controllers and front-end equipment (computers, printers, modems, etc.) shall be conducted to verify proper operation of both hardware and software. A checkout sheet itemizing each device and a description of the associated tests shall be prepared and submitted to the owner or owner's representative by the completion of the project.

H. System Acceptance Testing

All application software will be verified and compared against the sequences of operation. Control loops will be exercised by inducing a setpoint shift of at least 10% and observing whether the system successfully returns the process variable to setpoint. Record all test results and attach to the Test Results Sheet.

I. Test each alarm in the system and validate that the system generates the appropriate alarm message, that the message appears at all prescribed destinations (workstations or printers), and that any other related actions occur as defined (i.e. graphic panels are invoked, reports are generated, etc.). Submit a Test Results Sheet to the owner.

J. Perform an operational test of each unique graphic display and report to verify that the item exists, that the appearance and content are correct, and that any special features work as intended. Submit a Test Results Sheet to the owner.

K. Perform an operational test of each third party interface that has been included as part of the automation system. Verify that all points are properly polled, that alarms have been configured, and that any associated graphics and reports have been completed. If the interface involves a file transfer over Ethernet, test any logic that controls the transmission of the file, and verify the content of the specified information.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes control valves and actuators for DDC systems.

1.3 DEFINITIONS

A. Cv: Design valve coefficient.

B. DDC: Direct-digital control.

C. NBR: Nitrile butadiene rubber.

D. PTFE: Polytetrafluoroethylene

E. RMS: Root-mean-square value of alternating voltage, which is the square root of the mean value of the square of the voltage values during a complete cycle.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
3. Product description with complete technical data, performance curves, and product specification sheets.
4. Installation, operation, and maintenance instructions, including factors affecting performance.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include details of product assemblies. Indicate dimensions, weights, loads, and required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Include diagrams for pneumatic signal and main air tubing.

C. Delegated-Design Submittal:

1. Schedule and design calculations for control valves and actuators, including the following:

a. Flow at project design and minimum flow conditions.
b. Pressure differential drop across valve at project design flow condition.
c. Maximum system pressure differential drop (pump close-off pressure) across valve at project minimum flow condition.
d. Design and minimum control valve coefficient with corresponding valve position.
e. Maximum close-off pressure.
f. Leakage flow at maximum system pressure differential.
g. Torque required at worst case condition for sizing actuator.
h. Actuator selection indicating torque provided.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plan drawings and corresponding product installation details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Control valve installation location shown in relationship to room, duct, pipe, and equipment.
2. Size and location of wall access panels for control valves installed behind walls.
3. Size and location of ceiling access panels for control valves installed above inaccessible ceilings.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For control valves to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASME Compliance: Fabricate and label products to comply with ASME Boiler and Pressure Vessel Code where required by authorities having jurisdiction.

C. Delegated Design: Engage a qualified professional, to size products where indicated as delegated design.

D. Ground Fault: Products shall not fail due to ground fault condition when suitably grounded.

E. Backup Power Source: Systems and equipment served by a backup power source shall have associated control valve actuators served from a backup power source.

F. Environmental Conditions:

1. Provide electric control valve actuators, with protective enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Electric control valve actuators not available with integral enclosures, complying with requirements indicated, shall be housed in protective secondary enclosures.

    a. Hazardous Locations: Explosion-proof rating for condition.

G. Body & Trim. Body and trim style and materials shall be in accordance with the manufacturer's recommendations for design conditions and service shown in compliance with the following at a minimum:
1. Valve pattern, three-way or straight through, shall be as indicated on Drawings.
2. Modulating two-way pattern control valves shall have equal percentage flow-throttling characteristics unless otherwise indicated.
3. Modulating three-way pattern water valves shall have linear flow-throttling characteristics. The total flow through the valve shall remain constant regardless of the valve's position.
4. Valve bodies shall meet or exceed pressure and temperature class rating based upon design operating temperature and 150% design operating pressure. Unless otherwise specified or scheduled, minimum body rating for any valve is 125 psi and a maximum fluid temperature of 350˚F.
5. Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation.
6. Globe valves shall have replaceable seats.

H. Determine control valve sizes and flow coefficients by ISA 75.01.01.
1. Water Valves. Unless otherwise specified or scheduled, water valves shall follow the following criteria:
    a. Two-position service: Line size.
    b. Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through the heat exchanger (coil, load, etc.), 50% of the pressure difference between the supply and return mains, or 5 psi (Maximum).
    c. Three-way modulating service: Pressure drop shall be equal to twice the pressure drop through the heat exchanger (coil, load, etc.), (5 psi) maximum.
    d. Valves 1/2" through 2" shall be bronze or cast brass body ANSI Class 250, spring-loaded, PTFE packing quick opening for two-position service.
    e. Valves larger than 2 ½" and shall be cast iron ANSI Class 125 with guided plug and PTFE packing.
    f. Valves 1/2" through 2" shall be ANSI/ASME B1.20.1 (NPT) threaded connections.
    g. Valves 2 ½"to 3" shall use flanged connections.

I. Control valve characteristics and rangeability of 50:1 and shall comply with ISA 75.11.01.

J. Control valve shutoff classifications shall be FCI 70-2, Class IV. Close-Off/Differential Pressure Rating. All valves shall be guaranteed to have not more than 1% leakage of design flow rate at the pump shut-off pressure. All valve actuators and trim shall be furnished to provide the following minimum close-off pressure ratings unless otherwise specified or scheduled:
1. Two-way water valves: 150% of total system (pump) head.
2. Three-way water valves: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head (whichever is greater).
3. Steam valves: 150% of operating (inlet) pressure.

K. Fail positions unless otherwise indicated:
1. Chilled Water: close
2. Condenser Water: close
3. Heating Hot Water: Open.
4. Steam: Open.

L. General Characteristics:

1. In water systems, use ball- or globe-style control valves for two-position control for valves NPS 2 and smaller and butterfly style for valves larger than NPS 2. Butterfly valves shall be for open close service only.
2. In steam systems, use ball- or globe-style control valves regardless of size.
3. Pneumatic, two-position control valves shall provide a smooth opening and closing characteristic slow enough to avoid water hammer. Valves with pneumatic actuators shall have an adjustable opening time (valve full closed to full open) and an adjustable closing time (valve full open to full closed) ranging from zero to 10 seconds. Opening and closing times shall be independently adjustable. (Not Used This Project)
4. Control valve, pneumatic-control signal shall not exceed 200 feet. For longer distances, provide an electric/electronic control signal to the valve and an electric solenoid valve or electro-pneumatic transducer at the valve to convert the control signal to pneumatic. (Not Used This Project).
5. Valves for chilled water shall use all internal trim, (including seats, rings, modulating plugs and springs), of 316 stainless steel, regardless of body style.
6. Valves for hot water service between 210F and 250F shall have all internal trim (including seats, rings, modulating plugs and springs) of Type 316 Stainless Steel
7. Valves for hot water service below 210F shall have all internal trim (including seats, rings, modulating plugs and springs) of Brass, Bronze or Type 316 Stainless Steel

2.2 BALL-STYLE CONTROL VALVES

A. General:
1. All control ball valves shall feature characterized flow guides when used for modulating applications.

B. Ball Valves with Single Port and Characterized Disk:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Belimo Aircontrols (USA), Inc

2. Pressure Rating for NPS 1 and Smaller: Nominal 600 WOG.
3. Pressure Rating for NPS 1-1/2 through NPS 2: Nominal 400 WOG.
4. Close-off Pressure: 200 psig.
5. Process Temperature Range: Zero to 212 deg F.
6. Body and Tail Piece: Cast bronze ASTM B 61, ASTM B 62, ASTM B 584, or forged brass with nickel plating.
7. End Connections: Threaded (NPT) ends.
8. Ball: Chrome-plated brass or bronze or 300 series stainless steel.
9. Stem and Stem Extension:

    a. Material to match ball.
    b. Blowout-proof design.
    c. Sleeve or other approved means to allow valve to be opened and closed without damaging the insulation or the vapor barrier seal.

10. Ball Seats: Reinforced PTFE.
11. Stem Seal: Reinforced PTFE packing ring with a threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means,

such as EPDM O-rings, are acceptable if an equivalent cycle endurance can be demonstrated by testing.

12. Flow Characteristic: Equal percentage.

C. Ball Valves with Two Ports and Characterized Disk:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Belimo Aircontrols (USA), Inc.

2. Pressure Rating for NPS 1 and Smaller: Nominal 600 WOG.
3. Pressure Rating for NPS 1-1/2 through NPS 2: Nominal 400 WOG.
4. Close-off Pressure: 200 psig.
5. Process Temperature Range: Zero to 212 deg F.
6. Body and Tail Piece: Cast bronze ASTM B 61, ASTM B 62, ASTM B 584, or forged brass with nickel plating.
7. End Connections: Threaded (NPT) ends.
8. Ball: Chrome-plated brass or bronze or 300 series stainless steel].
9. Stem and Stem Extension:

    a. Material to match ball.
    b. Blowout-proof design.
    c. Sleeve or other approved means to allow valve to be opened and closed without damaging the insulation or the vapor barrier seal.

10. Ball Seats: Reinforced PTFE.
11. Stem Seal: Reinforced PTFE packing ring with a threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means, such as EPDM O-rings, are acceptable if an equivalent cycle endurance can be demonstrated by testing.
12. Flow Characteristics for A-Port: Equal percentage.
13. Flow Characteristics for B-Port: Modified for constant common port flow.

D. Ball Valves with Single Port and Segmented Ball:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Valve Solutions, Inc.

2. ASME B16.10 face-to-face dimensions.
3. Valves NPS 2 and Smaller: Threaded (NPT) ends.
4. Valves NPS 2-1/2 through NPS 6: Flanged ends suitable for mating to ASME B16.5 flanges.
5. Body: Carbon or stainless steel.
6. Ball and Shaft: Stainless steel.
7. Shaft and Segmented Ball: Pinned and welded.
8. Ball Seat: Graphite.
9. Packing: PTFE V-rings and graphite packing follower.
10. Replaceable seat, ball, and shaft packing.
11. Label each valve with following:

    a. Manufacturer's name, model number, and serial number.
    b. Body size.

c. Flow directional arrow.

E. Ball Valves with Segmented Ball, Three-Way Pattern:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Valve Solutions, Inc.

2. Arrangement: Two single-port valves mated to a fabricated tee with interconnecting mechanical linkage.
3. Performance:

a. Process Temperature Rating: Minus 20 to plus 450 deg F.
b. ASME B16.34, Class 300.
c. Leakage: FCI 70-2, Class IV.
d. Rangeability: 300 to 1.
e. Rotation: Zero to 90 degrees.
f. Equal percentage flow characteristic.

4. Face-to-Face Dimensions: ASME B16.10.
5. Valves NPS 3through NPS 6: Flanged ends suitable for mating to ASME B16.5 flanges.
6. Body: Carbon or stainless steel.
7. Ball and Shaft: Stainless steel.
8. Shaft and Segmented Ball: Pinned and welded.
9. Ball Seat: Graphite.
10. Packing: PTFE V-rings and graphite packing follower.
11. Replaceable seat, ball, and shaft packing.
12. Label each valve with following:

a. Manufacturer's name, model number, and serial number.
b. Body size.
c. Flow directional arrow.

F. Ball Valves with Full Ball and Characterized V-Notch:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Flow-Tek, Inc.

2. Performance:

a. Process Temperature Rating: Minus 20 to plus 500 deg F.
b. ASME B16.34, Class 600 for NPS 2 and smaller; Class 150 or Class 300 for larger than NPS 2.
c. Leakage: FCI 70-2, Class VI, bi-directional.
d. Rangeability: Varies from 200 to 1 up to 800 to 1 based on notch pattern of ball.
e. Rotation: Zero to 90 degrees.
f. Equal percentage flow characteristic.
g. Full port.

3. Face-to-Face Dimension: ASME B16.10 long pattern.
4. Valves NPS 2 and Smaller: ASME B1.20.1 threaded (NPT) ends and three-piece body.

5. Valves NPS 2-1/2 through NPS 12: Flanged ends suitable for mating to ASME B16.5 flanges and two-piece body.
6. Hole in the stem slot of each ball equalizes pressure between the body cavity and the line media flow.
7. Replaceable seat, ball, and shaft packing.
8. Body: Carbon or stainless steel.
9. Ball and Shaft: Stainless steel.
10. Ball Seat: RPTFE.
11. Stem Seals for Valves NPS 2 and Smaller: Live-loaded, self-adjusting, primary and secondary sealing using belleville washers.

    a. Primary Seal: Combination of thrust washer and thrust washer protector.
    b. Secondary Seal: Adjustable stem packing composed of RPTFE V-rings.

12. Stem Seals for Valves Larger than NPS 2: Independent packing gland, adjusted without removing mounting hardware or operator, and contoured to uniformly distribute load across packing.

    a. Primary Seal: Combination of thrust washer and thrust washer protector.
    b. Secondary Seal: Adjustable stem packing composed of RPTFE V-rings.

13. Label each valve with following:

    a. Manufacturer's name, model number, and serial number.
    b. Body size.
    c. Flow directional arrow.

G. Pressure-Independent Ball Valves NPS 2 and Smaller:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Belimo Aircontrols (USA), Inc.
    b. HCI; Hydronics Components Inc.

2. Integral Pressure Regulator: Located upstream of ball to regulate pressure, to maintain a constant pressure differential while operating within a pressure differential range of 5 to 50 psig.
3. Body: Forged brass, nickel plated, and with threaded ends.
4. Ball: Chrome-plated brass.
5. Stem and Stem Extension: Chrome-plated brass, blowout-proof design.
6. Stem sleeve or other approved means to allow valve to be opened and closed without damaging field-applied insulation and insulation vapor barrier seal.
7. Ball Seats: Reinforced PTFE.
8. Stem Seal: Reinforced PTFE packing ring stem seal with threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means, such as EPDM O-rings, are acceptable if equivalent cycle endurance can be achieved.
9. Flow Characteristic: Equal percentage.

2.3 BUTTERFLY-STYLE CONTROL VALVES

A. General:

1. Unless otherwise indicated, butterfly valves shall have a minimum range ability of 10:1. All valves shall be guaranteed to have not more than 1% leakage of design flow rate at the pump shut-off pressure.
2. Flanges shall meet all ANSI 125 and ANSI 150 standards.
3. Valve shall have a long stem design to accommodate 2 inches insulation.

B. Two-Way Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Keystone; Tyco Flow Control.

2. Body: Cast iron ASTM A 126, Class B, ductile iron ASTM A 536 or cast steel ASTM A 216/A 216M WCB fully lugged, suitable for mating to ASME B16.5 flanges.
3. Disc: 316 stainless steel.
4. Shaft: 316 or 17-4 PH stainless steel.
5. Seat: Reinforced EPDM or reinforced PTFE with retaining ring.
6. Shaft Bushings: Reinforced PTFE or stainless steel.
7. Replaceable seat, disc, and shaft bushings.
8. Corrosion-resistant nameplate indicating:

    a. Manufacturer's name, model number, and serial number.
    b. Body size.
    c. Body and trim materials.
    d. Flow arrow.

C. Three-Way Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Keystone; Tyco Flow Control.

2. Arrangement: Two valves mated to a fabricated tee with interconnecting mechanical linkage.
3. Performance:

    a. Bi-directional bubble tight shutoff at 250 psig.
    b. Comply with MSS SP-67 or MSS SP-68.
    c. Rotation: Zero to 90 degrees.
    d. Linear or modified equal percentage flow characteristic.

4. Body: Cast iron ASTM A 126, Class B, ductile iron ASTM A 536 or cast steel ASTM A 216/A 216M WCB fully lugged, suitable for mating to ASME B16.5 flanges.
5. Disc: 316 stainless steel.
6. Shaft: 316 or 17-4 PH stainless steel.
7. Seat: Reinforced EPDM or reinforced PTFE seat with retaining ring.
8. Shaft Bushings: Reinforced PTFE or stainless steel.
9. Replaceable seat, disc, and shaft bushings.
10. Corrosion-resistant nameplate indicating:

    a. Manufacturer's name, model number, and serial number.
    b. Body size.
    c. Body and trim materials.

d. Flow arrow.

2.4 GLOBE-STYLE CONTROL VALVES

A. General Globe-Style Valve Requirements:

1. Globe-style control valve body dimensions shall comply with ISA 75.08.01.
2. Construct the valves to be serviceable from the top.
3. For cage guided valves, trim shall be field interchangeable for different valve flow characteristics, such as equal percentage, linear, and quick opening.
4. Reduced trim for one nominal size smaller shall be available for industrial valves NPS 1 and larger.
5. Replaceable seats and plugs.
6. Furnish each control valve with a corrosion-resistant nameplate indicating the following:

    a. Manufacturer's name, model number, and serial number.
    b. Body and trim size.
    c. Arrow indicating direction of flow.

B. Two-Way Globe Valves NPS 2 and Smaller:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Johnson Controls, Inc.

2. Globe Style: Single port.
3. Body: Cast bronze or forged brass with ASME B16.5, Class 250 rating.
4. End Connections: Threaded.
5. Bonnet: Screwed.
6. Packing: PTFE V-ring.
7. Plug: Top guided.
8. Plug, Seat, and Stem: Brass or stainless steel.
9. Process Temperature Range: 35 to 248 deg F.
10. Ambient Operating Temperature: 35 to 150 deg F.
11. Leakage: FCI 70-2, Class IV.
12. Rangeability: 25 to 1.
13. Equal percentage flow characteristic.

C. Three-Way Globe Valves NPS 2 and Smaller:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Johnson Controls, Inc.

2. Globe Style: Mix flow pattern.
3. Body: Cast bronze or forged brass with ASME B16.5, Class 250 rating.
4. End Connections: Threaded.
5. Bonnet: Screwed.
6. Packing: PTFE V-ring.
7. Plug: Top guided.
8. Plug, Seat, and Stem: Brass or stainless steel.
9. Process Temperature Range: 35 to 248 deg F.

10. Ambient Operating Temperature: 35 to 150 deg F.
11. Leakage: FCI 70-2, Class IV.
12. Rangeability: 25 to 1.
13. Linear flow characteristic.

D. Two-Way Globe Valves NPS 2-1/2 to NPS 6:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Johnson Controls, Inc.

2. Globe Style: Single port.
3. Body: Cast iron complying with ASME B61.1, Class 125.
4. End Connections: Flanged, suitable for mating to ASME B16.5, Class 150 flanges.
5. Bonnet: Bolted.
6. Packing: PTFE cone-ring.
7. Plug: Top or bottom guided.
8. Plug, Seat, and Stem: Brass or stainless steel.
9. Process Temperature Rating: 35 to 281 deg F.
10. Leakage: 0.1 percent of maximum flow.
11. Rangeability: Varies with valve size between 6 and 10 to 1.
12. Modified linear flow characteristic.

E. Three-Way Globe Valves NPS 2-1/2 to NPS 6:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Johnson Controls, Inc.

2. Globe Style: Mix flow pattern.
3. Body: Cast iron complying with ASME B61.1, Class 125.
4. End Connections: Flanged suitable for mating to ASME B16.5, Class 150 flanges.
5. Bonnet: Bolted.
6. Packing: PTFE cone-ring.
7. Plug: Top or bottom guided.
8. Plug, Seat, and Stem: Brass or stainless steel.
9. Process Temperature Rating: 35 to 281 deg F.
10. Leakage: 0.1 percent of maximum flow.
11. Rangeability: Varies with valve size between 6 and 10 to 1.
12. Modified linear flow characteristic.

2.5 SOLENOID VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. ASCO Valve, Inc.

B. Description:

1. Action: Either normally open or normally closed in the event of electrical power failure as required by the application.
2. Size to close against the system pressure.

3. Manual override capable.
4. Heavy-duty assembly.
5. Body: Brass or stainless steel.
6. Seats and Discs: NBR or PTFE.
7. Solenoid Enclosure: NEMA 250, Type 4.

2.6 SELF-CONTAINED TEMPERATURE REGULATING VALVE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Jordan Valve; Richards Industries Company.

B. Description:

1. Self-contained and self-operated temperature regulating valve. Direct acting or reverse acting as required by application.
2. Direct Acting: A rise in temperature at the sensing bulb vaporizes some of the liquid in the bulb, forcing the remaining liquid through a capillary to apply pressure at the diaphragm, in turn closing the valve. The valve shall fail open.
3. Reverse Acting: A rise in temperature at the sensing bulb vaporizes some of the liquid in the bulb, forcing the remaining liquid through a capillary to apply pressure at the diaphragm, in turn opening the valve. The valve shall fail close.
4. Body: Carbon steel.
5. Trim and Seats: 300 series stainless steel.
6. Yoke: Cast iron.
7. Actuator: 300 series stainless steel.
8. End Connections: Threaded.
9. Capillary, Bulb, and Armor: 300 series stainless steel.
10. Thermal Fill Material: Match to the temperature range.
11. Thermowell: Type 316 stainless-steel thermowell sized to fit the bulb and pipe.

C. Operational Characteristics: Control flow from between 5 to 100 percent of rated capacity.

D. Interchangeable trim for one size smaller.

E. Valve Leakage: Comply with FCI 70-2, Class IV.

F. Temperature Range: Match application.

1. Drains from Hot Equipment to Sanitary Sewer System: 105 to 165 deg F.

G. Valve Size: Size to pass the design flow required with not more than 95 percent of the stem lift while operating at design pressure.

2.7 ELECTRIC AND ELECTRONIC CONTROL VALVE ACTUATORS

A. Actuators for Hydronic Control Valves: Capable of closing valve against system pump shutoff head.

B. Actuators for Steam Control Valves: Shutoff against 1.5 times steam design pressure.

C. Position indicator and graduated scale on each actuator.

D. Type: Motor operated, with or without gears, electric and electronic.

E. Voltage: 24-V ac.

F. Deliver torque required for continuous uniform movement of controlled device from limit to limit when operated at rated voltage.

G. Function properly within a range of 85 to 120 percent of nameplate voltage.

H. Construction:

1. For Actuators Less Than 100 W: Fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings, and pressed steel enclosures.
2. For Actuators from 100 to 400 W: Gears ground steel, oil immersed, shaft hardened steel running in bronze, copper alloy or ball bearings. Operator and gear trains shall be totally enclosed in dustproof cast-iron, cast-steel or cast-aluminum housing.
3. For Actuators Larger Than 400 W: Totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.
4. All control valves shall have a visual position indicator.
5. All non-spring return actuators shall have an external clutch/manual gear release to allow manual positioning of the valve when the actuator is not powered. Spring return actuators with more than 60-in-LB torque capacity shall have a manual crank for this purpose. In lieu of a manual positioning device, it will be acceptable for the contractor to provide a full line size bypass around the control valve. Three bypass shut off valves shall be provided to allow the control valve to be isolated while the open stop valve in the bypass allows flow around the control valve.

I. Field Adjustment:

1. Spring Return Actuators: Easily switchable from fail open to fail closed in the field without replacement.
2. Gear Type Actuators: External manual adjustment mechanism to allow manual positioning when the actuator is not powered.

J. Two-Position Actuators: Single direction, spring return or reversing type.

K. Modulating Actuators:

1. Operation: Capable of stopping at all points across full range and starting in either direction from any point in range.
2. Control Input Signal:

a. Three Point, Tristate, or Floating Point: Clockwise and counter-clockwise inputs. One input drives actuator to open position and other input drives actuator to close position. No signal of either input remains in last position.
b. Proportional: Actuator drives proportional to input signal and modulates throughout its angle of rotation. Suitable for zero- to 10- or 2- to 10-V dc 4- to 20-mA signals.
c. Pulse Width Modulation (PWM): Actuator drives to a specified position according to pulse duration (length) of signal from a dry contact closure, triac sink, or source controller.
d. Programmable Multi-Function:

1) Control Input, Position Feedback, and Running Time: Factory or field programmable.

2) Diagnostic: Feedback of hunting or oscillation, mechanical overload, mechanical travel, and mechanical load limit.
3) Service Data: Include, at a minimum, number of hours powered and number of hours in motion.

3. All modulating actuators shall have an external, built-in switch to allow the reversing of direction of rotation.

L. Position Feedback:

1. Equip where indicated two-position actuators with limits switches or other positive means of a position indication signal for remote monitoring of open and close position.
2. Equip where indicated, equip modulating actuators with a position feedback through current or voltage signal for remote monitoring.
3. Provide a position indicator and graduated scale on each actuator indicating open and closed travel limits.

M. Fail-Safe:

1. Where indicated, provide actuator to fail to an end position.
2. Internal spring return mechanism to drive controlled device to an end position (open or close) on loss of power.
3. Batteries, capacitors, and other non-mechanical forms of fail-safe operation are acceptable only where uniquely indicated.
4. Any mechanical equipment with direct introduction of outside air shall require fail-safe spring return valve actuators. Terminal equipment (VAV ATU, &c.) without direct introduction of outside air are permitted to have actuators that maintain their last commanded position when power is lost to the actuator. Equipment isolation and differential or temperature pressure bypass valves shall not be required to be provided with a spring return actuator provided that a failure of the valve to return to its “fail-safe” position will not incur damage to property or the system it serves.

N. Integral Overload Protection:

1. Provide against overload throughout the entire operating range in both directions.
2. Electronic overload, digital rotation sensing circuitry, mechanical end switches, or magnetic clutches are acceptable methods of protection.

O. Valve Attachment:

1. Unless otherwise required for valve interface, provide an actuator designed to be directly coupled to valve shaft without the need for connecting linkages.
2. Attach actuator to valve drive shaft in a way that ensures maximum transfer of power and torque without slippage.
3. Bolt and set screw method of attachment is acceptable only if provided with at least two points of attachment.

P. Temperature and Humidity:

1. Temperature: Suitable for operating temperature range encountered by application with minimum operating temperature range of minus 20 to plus 120 deg F.
2. Humidity: Suitable for humidity range encountered by application; minimum operating range shall be from 5 to 95 percent relative humidity, non-condensing.

Q. Enclosure:

1. Suitable for ambient conditions encountered by application.
2. NEMA 250, Type 2 for indoor and protected applications.
3. NEMA 250, Type 4 or Type 4X for outdoor and unprotected applications.
4. Provide actuator enclosure with heater and control where required by application.
5. Actuators used in wet conditions and/or in or near outdoor air streams shall have NEMA 2 housings.

R. Stroke Time:

1. Operate valve from fully closed to fully open within 60 75 90 150 Insert number seconds.
2. Operate valve from fully open to fully closed within 60 seconds.
3. Move valve to failed position within 15 seconds.
4. Select operating speed to be compatible with equipment and system operation.

S. Sound:

1. Spring Return: 62 dBA.
2. Non-Spring Return: 45 dBA.

2.8 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies & Control Transformers. Control transformers and power supplies shall be UL-Listed. Provide Class 2 current-limiting type or over-current protection in both primary and secondary circuits for Class 2 service not to exceed 100 VA in accordance with the applicable following requirements or as directed by the AHJ.
1. NEC 2011 (NFPA 70) Chapter 7 Article 725 – Class 1, Class 2 and Class 3 Remote-Control, Signaling and Power-Limited Circuits.
2. NEC 2011 (NFPA 70) Chapter 9 Table 11(A) and Table 11(B).
3. Canadian Electrical Code, Part 1 (CSA C22.1-12) Rule 16-200.

B. DC Power Supplies. DC power supply output shall match output current and voltage requirements. Power supply shall be half-wave rectified type with the following minimum specifications:
1. Output ripple: 5.0 mV maximum peak-to-peak.
2. Regulation: 1.0% line and load combined.
3. Response: 100 ms for 50% load changes.
4. Built-in overvoltage and overcurrent protection and able to withstand a 150% current overload for a minimum of three (3) seconds without tripping or failure.

C. Power Line Filtering. Provide transient voltage and surge suppression for all workstations and controllers either internally or as an external component.

D. Valve Actuators shall be modulating, floating (tri-state) with feedback signal, two-position and spring return fail safe as called out in the control sequence of operation or indicated on the drawings. All modulating valves shall be positive positioning, and respond to a [0-10VDC] [2-10 VDC] [4-20 mA with a load resistor] with the exception that terminal unit zone valves may use an actuator that responds to a floating or tri-state with feedback signal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for valves installed in piping to verify actual locations of piping connections before installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONTROL VALVE APPLICATIONS

A. Unless otherwise noted, controls valves shall be globe pattern.

B. Do not use butterfly valves for steam service or modulating applications.

3.3 INSTALLATION, GENERAL

A. Furnish and install products required to satisfy most stringent requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Properly support instruments, tubing, piping, wiring, and conduits to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to a force.

D. Provide ceiling, floor, roof, and wall openings and sleeves required by installation. Before proceeding with drilling, punching, or cutting, check location first for concealed products that could potentially be damaged. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

E. Firestop penetrations made in fire-rated assemblies and seal penetrations made in acoustically rated assemblies.

F. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that will cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

G. Install products in locations that are accessible and that will permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

H. Corrosive Environments:

1. Use products that are suitable for environment to which they will be subjected.
2. If possible, avoid or limit use of materials in corrosive environments, including. but not limited to, the following:

    a. Laboratory exhaust airstreams.
    b. Process exhaust airstreams.

3. Use Type 316 stainless-steel tubing and fittings when in contact with a corrosive environment.
4. When conduit is in contact with a corrosive environment, use Type 316 stainless-steel conduit and fittings or conduit and fittings that are coated with a corrosive-resistant coating that is suitable for environment.
5. Where control devices are located in a corrosive environment and are not corrosive resistant from manufacturer, field install products in a NEMA 250, Type 4X enclosure constructed of Type 316L stainless steel.

3.4 ELECTRIC POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."

C. Furnish and install power wiring, as per electrical specifications.

D. Furnish and install raceways as per electrical specifications.

E. Electrical subcontractor shall provide all required line voltage. The mechanical subcontractor shall provide all low voltage wiring and power supply transformers in coordination with the control’s subcontractor and control actuator requirements.

3.5 CONTROL VALVES

A. Install pipe reducers for valves smaller than line size. Position reducers as close to valve as possible but at distance to avoid interference and impact to performance. Install with manufacturer-recommended clearance.

B. Install flanges or unions to allow drop-in and -out valve installation.

C. Where indicated, install control valve with three-valve bypass manifold to allow for control valve isolation and removal without interrupting system flow by providing manual throttling valve in bypass pipe.

D. Install drain valves in piping upstream and downstream of each control valve installed in a three-valve manifold and for each control valve larger than NPS 4.

E. Install pressure temperature taps in piping upstream and downstream of each control valve larger than NPS 2.

F. Valve Orientation:

1. Where possible, install globe and ball valves installed in horizontal piping with stems upright and not more than 15 degrees off of vertical, not inverted.

2. Install valves in a position to allow full stem movement.
3. Where possible, install butterfly valves that are installed in horizontal piping with stems in horizontal position and with low point of disc opening with direction of flow.

G. Clearance:

1. Locate valves for easy access and provide separate support of valves that cannot be handled by service personnel without hoisting mechanism.
2. Install valves with at least 12 inches of clear space around valve and between valves and adjacent surfaces.

H. Threaded Valves:

1. Note internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.
2. Align threads at point of assembly.
3. Apply thread compound to external pipe threads, except where dry seal threading is specified.
4. Assemble joint, wrench tight. Apply wrench on valve end as pipe is being threaded.

I. Flanged Valves:

1. Align flange surfaces parallel.
2. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

3.6 CONNECTIONS

A. Connect electrical devices and components to electrical grounding system. Comply with electrical specifications.

3.7 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 230553.

B. Install engraved phenolic nameplate with valve identification on valve.

3.8 CLEANING

A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.

B. Wash and shine glazing.

C. Polish glossy surfaces to a clean shine.

3.9 CHECKOUT PROCEDURES

A. Control Valve Checkout:

1. Check installed products before continuity tests, leak tests, and calibration.
2. Check valves for proper location and accessibility.
3. Check valves for proper installation for direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.
4. For pneumatic products, verify air supply for each product is properly installed.
5. For pneumatic valves, verify that pressure gauges are provided in each air line to valve actuator and positioner.
6. Verify that control valves are installed correctly for flow direction.
7. Verify that valve body attachment is properly secured and sealed.
8. Verify that valve actuator and linkage attachment are secure.
9. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
10. Verify that valve ball, disc, and plug travel are unobstructed.
11. After piping systems have been tested and put into service, but before insulating and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks. Replace the valve if leaks persist.

3.10 ADJUSTMENT, CALIBRATION, AND TESTING

A. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed back to 100 percent open.

B. Stroke control valves with pilot positioners. Adjust valve and positioner following manufacturer's recommended procedure, so valve is 100 percent closed, 50 percent closed, and 100 percent open at proper air pressures.

C. Check and document open and close cycle times for applications with a cycle time of less than 30 seconds.

D. For control valves equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes control sequences for DDC for HVAC systems, subsystems, and equipment.

B. Related Requirements:

1. Section 230923 "DDC Systems for HVAC" for control equipment.

1.3 DEFINITIONS

A. Analog Output: Proportional output signal (zero- to 10-V dc, 4 to 20 mA).

B. Binary Output: On/off output signal or contact closure.

C. DDC: Direct digital control.

D. Digital Output: Data output that must be interpreted digitally.

1.4 ACTION SUBMITTALS

A. Product Data:

1. An instrumentation list for each controlled system. Label each element of the controlled system in table format. Show, in the table element name, type of device, manufacturer, model number, and control device product data sheet number.
2. A complete description of the operation of the control system, including sequences of operation. Include and reference a schematic diagram of the controlled system.

B. Shop Drawings:

1. Riser diagrams showing control network layout, communication protocol, and wire types.
2. Schematic diagram of each controlled system. Include all control points labeled with point names shown or listed. Show the location of control elements in the system.
3. Wiring diagram for each controlled system. Show all control elements labels. Where a control element is the same as that shown on the control system schematic, label with the same name. Label all terminals.

1.5 HEATING CONTROL SEQUENCES

1.6 TERMINAL UNIT OPERATING SEQUENCE

A. Cabinet Unit Heater, Hydronic:

1. Space Temperature:

a. Input:

1) Device: Line-voltage thermostat.
2) Location: Space.

b. Output:

1) Device: Hard wired.
2) Location: Motor controller.
3) Transference: Starter relay.

c. Action: Cycle fan to maintain 75 deg F space temperature.

2. Space Temperature:

a. Input:

1) Device: Air-temperature sensor or air-temperature sensor with air-temperature RTD transmitter.
2) Location: Occupied space.
3) Transference: DDC controller.

b. Output Device:

1) Device: Analog output.
2) Location: Control valve.
3) Transference: Control-valve actuator.

c. Action: Modulate valve to maintain 75 deg F space temperature.

3. Low-Temperature Safety:

a. Input Device: Line-voltage, on-off thermostat; mounted.

1) Device: Line-voltage thermostat.
2) Location: Return heating-water pipe.

b. Output Device:

1) Device: Hard wired.
2) Location: Motor controller.
3) Input Transference: Starter relay.

c. Action: Stop fan when **return heating-water** temperature falls below 35 deg F.

B. Variable-Air-Volume Terminal Air Units with Hydronic Coils:

1. Occupancy:

    a. Input:

        1) Device: Occupancy sensor.
        2) Location: Space.
        3) Transference: DDC controller.

    b. Device: DDC controller.
    c. Action: Report occupancy and enable occupied temperature set point.

        1) Occupied Cooling Temperature: 75 deg F.
        2) Occupied Heating Temperature: 70 deg F.
        3) Unoccupied Cooling Temperature: 80 deg F.
        4) Unoccupied Heating Temperature: 65 deg F.

2. Space Temperature:

    a. Input:

        1) Device: Air-temperature sensor or transmitter.
        2) Location: Space.
        3) Transference: DDC controller.

    b. Output:

        1) Device: Analog output.
        2) Location: Control damper and valve actuators.
        3) Input Transference: Control damper and valves.

    c. Action: Modulate damper and valve to maintain the following space temperature set points:

        1) Occupied Cooling Temperature: 75 deg F.
        2) Occupied Heating Temperature: 70 deg F.
        3) Unoccupied Cooling Temperature: 85 deg F.
        4) Unoccupied Heating Temperature: 65 deg F.
        5) Modulate damper actuator from full open to minimum position.
        6) When damper is at minimum position, modulate reheat coil valve from closed to open.
        7) If occupied space temperature is not maintained with valve open, modulate damper actuator from minimum position to 100 percent open.
        8) Reverse the sequence for full heating to full cooling.

C. Indicate the following on the operator's workstation display terminal:

1. DDC system graphic.
2. DDC system on-off indication (operating or not operating).
3. DDC system occupied/unoccupied mode.
4. Outdoor-air-temperature indication.
5. Cabinet Unit Heater, Hydronic:

    a. Space temperature indication.
    b. Space temperature set point.
    c. Fan on.

6. Variable-Air-Volume Terminal Air Units with Hydronic Coils:

    a. Space/area served.
    b. Space occupied/unoccupied.
    c. Space temperature indication.
    d. Space temperature set point.
    e. Space cooling and heating temperature set point, occupied.
    f. Space cooling and heating temperature set point, unoccupied.
    g. Air-damper position as percentage open.
    h. Control-valve position as percentage open.

1.7 VENTILATION SEQUENCES

A. Exhaust Fan: Timeclock.

1. Input:

    a. Device: Timeclock.

2. Output:

    a. Device: Hard wired.
    b. Location: Motor controller.
    c. Transference: Starter relay.

3. Action: Cycle fan on when during set building occupancy.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:

1. Hot-water heating piping. (glycol)
2. Makeup-water piping.
3. Condensate-drain piping.
4. Air-vent piping.
5. Safety-valve-inlet and -outlet piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Plastic pipe and fittings with solvent cement.
2. Pressure-seal fittings.
3. Chemical treatment.

B. Delegated-Design Submittal:

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors and alignment guides and expansion joints and loops.
3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
4. Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.
5. For underground piping provide size and quantity of pipe expansion loops and thrust blocks.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Other building services.
3. Structural members.

B. Qualification Data: For Installer.

C. Welding certificates.

D. Field quality-control reports.

E. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Hot-Water Heating Piping: 150 psig at 200 deg F.
2. Glycol -Water Piping: 150 psig at 150 deg F.
3. Makeup-Water Piping: 80 psig at 150 deg F.
4. Condensate-Drain Piping: 150 deg F.
5. Air-Vent Piping: 200 deg F.
6. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Copper or Bronze Pressure-Seal Fittings:
1. Pro-press should be reviewed.

2. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Elkhart Products Corporation.
    b. Mueller Industries, Inc.
    c. NIBCO INC.
    d. Viega LLC.

3. Housing: Copper.
4. O-Rings and Pipe Stops: EPDM.
5. Tools: Manufacturer's special tools.
6. Minimum 200-psig working-pressure rating at 250 deg F.

E. Wrought-Copper Unions: ASME B16.22.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

H. Steel Pressure-Seal Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Victaulic Company.
    b. Viega LLC.
    c. Zern
    d. Propress

2. Housing: Steel.
3. O-Rings and Pipe Stop: EPDM.
4. Tools: Manufacturer's special tool.
5. Minimum 300-psig working-pressure rating at 230 deg F.

I. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.4 PLASTIC PIPE AND FITTINGS (used for condensate drains not located in ceiling plenums only)

1. CPVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM F 438 for Schedule 40 pipe; ASTM F 439 for Schedule 80 pipe.

B. PVC Plastic Pipe: ASTM D 1785, with wall thickness as indicated in "Piping Applications" Article.

1. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2466 for Schedule 40 pipe; ASTM D 2467 for Schedule 80 pipe.

2.5 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

F. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

a. PVC solvent cement shall have a VOC content of 510 g/L or less.
b. Adhesive primer shall have a VOC content of 550 g/L or less.

H. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.6 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Charlotte Pipe and Foundry Company.
    b. IPEX USA LLC.
    c. KBI (King Bros. Industries).
    d. Viega LLC.

2. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.

2.7 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. WATTS.
    b. Wilkins.
    c. Zurn Industries, LLC.

2. Description:

    a. Standard: ASSE 1079.
    b. Pressure Rating: 150 psig 250 psig.
    c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. WATTS.
    b. Wilkins.
    c. Zurn Industries, LLC.

2. Description:

    a. Standard: ASSE 1079.
    b. Factory-fabricated, bolted, companion-flange assembly.
    c. Pressure Rating: 150 psig minimum at 250 deg F.
    d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Grinnell G-Fire by Johnson Controls Company.

b. Matco-Norca.
c. Victaulic Company.

2. Description:

a. Standard: IAPMO PS 66.
b. Electroplated steel nipple, complying with ASTM F 1545.
c. Pressure Rating: 300 psig at 225 deg F.
d. End Connections: Male threaded or grooved.
e. Lining: Inert and noncorrosive, propylene.

2.8 BYPASS CHEMICAL FEEDER (not used)

A. Description: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating, Piping aboveground; NPS 2 1/2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered, brazed, pressure-seal joints.
2. Schedule 40, Grade B, Type 96 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Hot-water heating, Piping aboveground; NPS 3 and larger, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered, brazed joints.
2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

C. Hot-water heating, Piping below ground and within slabs; shall be either of the following:

1. Type K, annealed-temper copper tubing, wrought-copper fittings, and brazed joints. Use the fewest possible joints.

D. Makeup-water piping installed aboveground shall be either of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

E. Makeup-Water Piping Installed Belowground and within Slabs: Type K, annealed-temper copper tubing, wrought-copper fittings, and soldered joints. Use the fewest possible joints.

F. Condensate-Drain Piping for AC Units: Type M coper, Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 PVC plastic pipe and fittings and solvent-welded joints. (PVC not to be used in return air plenums)

G. Boiler Condensate-Drain Piping: Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

H. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

I. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

J. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Section 230523.101 " Valves for HVAC Piping," Section 230523.12

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Install shutoff valve immediately upstream of each dielectric fitting.

T. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

X. For piping passing through equipment room walls to occupied spaces provide split seals for sound and vibration attenuation between rooms. Refer to section 232116.

3.3 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples, or unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges, or nipples.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 HANGERS AND SUPPORTS

A. Install vibration isolation hangers or supports on all piping connected to motor driven equipment for a distance of 20’ or the first two hangers. Refer to section 232116 Hydronic Piping specialties.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.

4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

C. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 6 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/4Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

D. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

E. Fiberglass Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
3. PVC Non-pressure Piping: Join according to ASTM D 2855.

I. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

J. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section 230519 "Meters and Gages for HVAC Piping."

3.7 CHEMICAL TREATMENT

A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the following water characteristics:

1. pH: 9.0 to 10.5.
2. "P" Alkalinity: 100 to 500 ppm.
3. Boron: 100 to 200 ppm.
4. Chemical Oxygen Demand: Maximum of 100 ppm. Revise this value if closed system contains glycol.
5. Corrosion Inhibitor:

    a. Sodium Nitrate: 1000 to 1500 ppm.
    b. Molybdate: 200 to 300 ppm.
    c. Chromate: 200 to 300 ppm.
    d. Sodium Nitrate Plus Molybdate: 100 to 200 ppm each.
    e. Chromate Plus Molybdate: 50 to 100 ppm each.

6. Soluble Copper: Maximum of 0.20 ppm.
7. Tolyiriazole Copper and Yellow Metal Corrosion Inhibitor: Minimum of 10 ppm.
8. Total Suspended Solids: Maximum of 10 ppm.
9. Ammonia: Maximum of 20 ppm.
10. Free Caustic Alkalinity: Maximum of 20 ppm.
11. Microbiological Limits:

a. Total Aerobic Plate Count: Maximum of 1000 organisms/mL.
b. Total Anaerobic Plate Count: Maximum of 100 organisms/mL.
c. Nitrate Reducers: 100 organisms/mL.
d. Sulfate Reducers: Maximum of zero organisms/mL.
e. Iron Bacteria: Maximum of zero organisms/mL.

B. Install bypass chemical feeders in each hydronic system where indicated.

1. Install in upright position with top of funnel not more than 48 inches above the floor.
2. Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections.
3. Install NPS 3/4 pipe from chemical feeder drain to nearest equipment drain and include a full-size, full-port, ball valve.

C. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

D. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes special-duty valves and specialties for the following:

1. Hot-water heating piping.
2. Makeup-water piping.
3. Condensate-drain piping.
4. Blowdown-drain piping.
5. Air-vent piping.
6. Safety-valve-inlet and -outlet piping.
7. Vibration Isolation
8. Expansion fittings for hydronic piping
9. Pipe guides and anchors

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
2. Air-control devices.
3. Hydronic specialties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.6 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Hot-Water Heating Piping: 150 psig at 200 deg F
2. Makeup-Water Piping: 80 psig at 150 deg F
3. Condensate-Drain Piping: 150 deg F.
4. Blowdown-Drain Piping: 200 deg F
5. Air-Vent Piping: 200 deg F.
6. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523 "Valves for HVAC Piping,"

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 230923.11 "Control Valves."

2.3 Bronze, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Armstrong Pumps, Inc.
   b. Bell & Gossett; a Xylem brand.
   c. Nexus Valve, Inc.
   d. TACO Comfort Solutions, Inc.
   e. Tour & Andersson; available through Victaulic Company.
   f. Victaulic Company.

2. Body: Bronze, ball or globe type with calibrated orifice or venturi.

3. Ball: Brass or stainless steel.
4. Seat: PTFE.
5. End Connections: Threaded or socket.
6. Pressure Gage Connections: Integral seals for portable differential pressure meter.
7. Handle Style: Lever, with memory stop to retain set position.
8. CWP Rating: Minimum 125 psig
9. Maximum Operating Temperature: 250 deg F

B. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong Pumps, Inc.
    b. Bell & Gossett; a Xylem brand.
    c. Nexus Valve, Inc.
    d. Tour & Andersson; available through Victaulic Company.

2. Body: Cast-iron or steel body, globe pattern with calibrated orifice or venturi.

3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig
11. Maximum Operating Temperature: 250 deg F

C. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett; a Xylem brand.
    d. Spence Engineering Company, Inc.
    e. Watts; a Watts Water Technologies company.

2. Body: Bronze or brass.

3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.
8. Inlet Strainer: stainless steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

D. Diaphragm-Operated Safety Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett; a Xylem brand.
    d. Spence Engineering Company, Inc.
    e. Watts; a Watts Water Technologies company.

2. Body: Bronze or brass.

3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: stainless steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

E. Automatic Flow-Control Valves: (NOT USED)

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Flow Design, Inc.
    b. Griswold Controls.
    c. Nexus Valve, Inc.
    d. NuTech Hydronic Specialty Products.

2. Body: Brass or ferrous metal.

3. Piston and Spring Assembly: Stainless steel, tamper proof, self-cleaning, and removable.
4. Combination Assemblies: Include bronze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig
9. Maximum Operating Temperature: 200 deg F

2.4 AIR-CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett; a Xylem brand.
    d. TACO Comfort Solutions, Inc.
    e. John Wood

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig
7. Maximum Operating Temperature: 225 deg F

C. Automatic Air Vents:
   1. Body: Bronze or cast iron.
   2. Internal Parts: Nonferrous.
   3. Operator: Noncorrosive metal float.
   4. Inlet Connection: NPS 1/2
   5. Discharge Connection: NPS 1/4
   6. CWP Rating: 150 psig
   7. Maximum Operating Temperature: 240 deg F

D. Expansion Tanks:
   1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested after taps are fabricated and shall be labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
   2. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig working pressure and 250 deg F maximum operating temperature.
   3. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
   4. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch- diameter gage glass, and slotted-metal glass guard.

E. Diaphragm or Bladder-Type Expansion Tanks as scheduled or noted on plans:
   1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test after taps are fabricated and supports installed and are labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
   2. Diaphragm or Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
   3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

F. Tangential-Type Air Separators:
   1. Tank: Welded steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature.
   2. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
   3. Tangential Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.
   4. Blowdown Connection: Threaded.
   5. Size: Match system flow capacity.

G. In-Line Air Separators:
   1. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
   2. Maximum Working Pressure: Up to 175 psig
   3. Maximum Operating Temperature: Up to 300 deg F

H. Air Purgers:
   1. Body: Cast iron with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal.
   2. Maximum Working Pressure: 150 psig
   3. Maximum Operating Temperature: 250 deg F

2.5 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, 20-mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig

B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig

C. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig

D. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig
5. Maximum Operating Temperature: 250 deg F

E. Spherical, Rubber, Flexible Connectors:

1. Rubber flexible connections shall be peroxide cured EPDM throughout with Kevlar tire cord reinforcement. The raised face rubber flanges must encase solid steel rings to prevent pull out. Flexible cable wire is not acceptable. Sizes 1-1/2" through 14" shall have a ductile iron external ring between the two spheres. Sizes 3/4" through 2” may have one sphere, bolted threaded flange assemblies and cable retention.

2. Minimum ratings shall be 250 psi at 170°F and 215 psi at 250°F. Higher published rated connectors may be used where required.

3. Safety factors shall be a minimum of 3/1. All flexible connections must be factory tested to 150% of maximum pressure for 12 minutes before shipment. The piping gap shall be equal to the length of the expansion joint under pressure. Control rods passing through 1/2" thick Neoprene washer bushings large enough to take the thrust at 1000psi of surface area may be used on unanchored piping where the manufacturer determines the condition exceeds the expansion joint rating without them.

4. All flexible joints shall be installed on the equipment side of the shut off valves. Expansion joints shall be SAFEFLEX SFDEJ, SFEJ, SFDCR or SFU and Control Rods CR as manufactured by Mason Industries, Inc
   a. Body: Fiber-reinforced rubber body.
   b. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
   c. Performance: Capable of misalignment.
   d. CWP Rating: 150 psig
   e. Maximum Operating Temperature: 250 deg F

F. Braided Pipe Flexible Connection;
   1. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3"and larger shall be flanged. Smaller sizes may have male nipples. Minimum sizes listed below.

Flanged (Pipe Dia x Flexible Pipe Length)		
3" x 12"	6" x 18"	12" x 24"
4" x 12"	8" x 18"	14" x 30"
5" x 18"	10" x 18"	16" x 32"

Male Nipples (Pipe Dia x Flexible Pipe Length)		
1/2" x 12"	1-1/4" x 12"	2" x 12"
3/4" x 12"	1-1/2"x 12"	2-1/2" x 18"
1" x 12"		

   2. At equipment connections, hoses shall be installed on the equipment side of the shut-off valves horizontal and parallel to the equipment shafts wherever possible. Hoses shall be type FFL or type MN as manufactured by Mason Industries, Inc

G. Vibration isolation pipe hangers; pre-compressed and locked at the rated deflection by means of a resilient up-stop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30° capability. Hangers shall be type PC30N as manufactured by Mason Industries, Inc

H. Acoustic Split Seals; consist of pipe halves with minimum 3/4" thick neoprene sponge cemented to the inner faces. The seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping. Grout seals to make it integral with the floor, wall or ceiling in masonry construction. Seals shall project a minimum of 1" past either face of the wall. Where temperatures exceed 240F, 10 lb. density fiberglass may be used in lieu of the sponge. Seals shall be Type SWS as manufactured by Mason Industries, Inc.

2.6 PACKLESS EXPANSION JOINTS

A. Metal, Compensator Packless Expansion Joints: Metraflex Model HPFF – for copper, Model HP for steel pipe

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Flexicraft Industries.
b. Mason Industries, Inc.
c. Metraflex Company (The).

2. Minimum Pressure Rating: 175 psig unless otherwise indicated.

3. Description: Totally enclosed, externally pressurized, multi-ply bellows isolated from fluid flow by an internal pipe sleeve and external housing.
4. Joint Axial Movement: 2 inches of compression and 1/2 inch of extension.
5. Configuration for Copper Tubing: Multi-ply, phosphor-bronze bellows with copper pipe ends.

a. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint or threaded.
b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Threaded.

6. Configuration for Steel Piping: Multi-ply, stainless-steel bellows; steel-pipe end connections; and carbon-steel shroud.

a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
b. End Connections for Steel Pipe NPS 2-1/2 to NPS 4: Threaded Welded.

2.7 GROOVED-JOINT EXPANSION JOINTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anvil International.
2. Grinnell G-Fire by Johnson Controls Company.
3. Victaulic Company.

B. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.

C. Standard: AWWA C606, for grooved joints.

D. Nipples: ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.

E. Couplings: flexible type for steel-pipe dimensions. Include ferrous housing sections, Buna-N gasket suitable for diluted acid, alkaline fluids, and cold and hot water, and bolts and nuts.

2.8 ALIGNMENT GUIDES AND ANCHORS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advanced Thermal Systems, Inc.
b. Flexicraft Industries.
c. Mason Industries, Inc.
d. Metraflex Company (The).

2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe.

3. Steel Shapes and Plates: ASTM A 36/A 36M.
4. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
5. Washers: ASTM F 844, steel, plain, flat washers.
6. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened concrete, with tension and shear capacities appropriate for application. Threaded stud, expansion plug, nuts and washers shall be zinc-coated carbon steel.

7. Chemical Fasteners: Insert-type stud, bonding-system anchor for use with hardened concrete, with tension and shear capacities appropriate for application.

    a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
    b. Stud: threaded stud washers and nuts shall be ASTM A 307, zinc-coated carbon steel.
    c. Alignment Guides
        1) Horizontal split spider type guide – Metraflex – Style IV
        2) Slide guide - – Metraflex – model PTFE
        3) Pre-insulated guide – Metraflex – model PG PRE
        4) Vertical glide riser - – Metraflex – model PGQ
    d. Anchors
        1) Anchor clamp – Metraflex – model PA
        2) Structural I Beam Anchors – Metraflex
        3) Pre-insulated Anchor – Metraflex – model PAPI
        4) Modular riser guide – Metraflex – modular riser with EPDM insert

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

G. All valves and specialties installed in the system shall have a pressure rating that exceeds the system working pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. All valves and specialties installed in the system shall have a pressure rating that exceeds the system working pressure.

B. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

C. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

D. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

E. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.

F. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

G. Install steel braided flexible pipe connections at all coil connections and at all piping connections to motor driven equipment.

H. Isolate piping from base mounted pumps with spherical rubber flexible connections

I. Install vibration isolation hangers or supports on all piping connected to motor driven equipment for a distance of 20’ or the first two hangers.

J. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

K. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements. System pressure shall be 5 psi minimum residual at the top of the system.

L. Install Acoustic split seals on all hydronic piping 2” and over, penetrating mechanical equipment room walls.

M. Install Packless expansion fittings in all hydronic pipe sections, regardless of service, that is over 75’ long straight run. Alternative pipe “expansion loop” may be used if space permits. Piping layout submittal shall indicate guide and ridged mount locations.

3.3 EXPANSION JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install grooved-joint expansion joints to grooved-end steel piping.

C. Grooved end pipe applications can use multiple grooved coupling installed in an arrangement as approved by the manufacturer for the specific application. The manufacturer shall recommend the number, placement and arrangement in the piping systems. Submit to the engineer for review and approval.

3.4 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.

C. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.5 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install one guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint or loop not more than three pipe diameters from expansion joint.

C. Attach guides to pipe, and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24; U bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Refrigerant pipes and fittings.
2. Refrigerant piping valves and specialties.
3. Refrigerants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve, refrigerant piping, and piping specialty.

1. Include pressure drop, based on manufacturer's test data, for the following:

a. Thermostatic expansion valves.
b. Solenoid valves.
c. Hot-gas bypass valves.
d. Filter dryers.
e. Strainers.
f. Pressure-regulating valves.

B. Sustainable Design Submittals:

1. Product Data for EA Prerequisite "Fundamental Refrigerant Management": For refrigerants, indicating compliance with refrigerant management practices.

C. Shop Drawings:

1. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
2. Show interface and spatial relationships between piping and equipment.
3. Shop Drawing Scale: 1/4-inch equals 1 foot.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to 2010 ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.7 PRODUCT STORAGE AND HANDLING

A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-134a:

1. Suction Lines for Air-Conditioning Applications: 115 psig.
2. Suction Lines for Heat-Pump Applications: 225 psig.
3. Hot-Gas and Liquid Lines: 225 psig.

B. Line Test Pressure for Refrigerant R-407C:

1. Suction Lines for Air-Conditioning Applications: 230 psig.
2. Suction Lines for Heat-Pump Applications: 380 psig.
3. Hot-Gas and Liquid Lines: 380 psig.

C. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type L – Refer to section 3 for applications.

B. ASTM B 280, Type ACR. – Refer to section 3 for applications

C. Wrought-Copper Fittings: ASME B16.22.

D. Wrought-Copper Unions: ASME B16.22.

E. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

F. Brazing Filler Metals: AWS A5.8/A5.8M.

G. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Working Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

H. Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, stainless-steel-wire-reinforced protective jacket.
2. End Connections:

a. NPS 2 and Smaller: With threaded-end connections.
b. NPS 2-1/2 and Larger: With flanged-end connections.

3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

A. Manufactures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Danfoss Inc.
b. Heldon Products; Henry Technologies.
c. Paul Mueller Company.
d. Danfoss Inc.
e. Parker Hannifin Corp.
f. Keep-Rite Co.

B. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.

2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

C. Packed-Angle Valves:
   1. Body and Bonnet: Forged brass or cast bronze.
   2. Packing: Molded stem, back seating, and replaceable under pressure.
   3. Operator: Rising stem.
   4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
   5. Seal Cap: Forged-brass or valox hex cap.
   6. End Connections: Socket, union, threaded, or flanged.
   7. Working Pressure Rating: 500 psig.
   8. Maximum Operating Temperature: 275 deg F.

D. Check Valves:
   1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
   2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
   3. Piston: Removable polytetrafluoroethylene seat.
   4. Closing Spring: Stainless steel.
   5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
   6. End Connections: Socket, union, threaded, or flanged.
   7. Maximum Opening Pressure: 0.50 psig.
   8. Working Pressure Rating: 500 psig.
   9. Maximum Operating Temperature: 275 deg F.

E. Service Valves:
   1. Body: Forged brass with brass cap including key end to remove core.
   2. Core: Removable ball-type check valve with stainless-steel spring.
   3. Seat: Polytetrafluoroethylene.
   4. End Connections: Copper spring.
   5. Working Pressure Rating: 500 psig.

F. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).
   1. Body and Bonnet: Plated steel.
   2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
   3. Seat: Polytetrafluoroethylene.
   4. End Connections: Threaded.
   5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
   6. Working Pressure Rating: 400 psig.
   7. Maximum Operating Temperature: 240 deg F.

G. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

   1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
   2. Piston, Closing Spring, and Seat Insert: Stainless steel.
   3. Seat: Polytetrafluoroethylene.
   4. End Connections: Threaded.
   5. Working Pressure Rating: 400 psig.
   6. Maximum Operating Temperature: 240 deg F.

H. Thermostatic Expansion Valves: Comply with AHRI 750.
   1. Body, Bonnet, and Seal Cap: Forged brass or steel.
   2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
   3. Packing and Gaskets: Non-asbestos.
   4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
   5. Suction Temperature: 40 deg F.
   6. Superheat: Adjustable or Nonadjustable.

7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 700 psig.

I. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
5. Seat: Polytetrafluoroethylene.
6. Equalizer: Internal or External.
7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter and 24-V ac coil.
8. End Connections: Socket.
9. Throttling Range: Maximum 5 psig.
10. Working Pressure Rating: 500 psig.
11. Maximum Operating Temperature: 240 deg F.

J. Straight-Type Strainers:
1. Body: Brass or welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig.
5. Maximum Operating Temperature: 275 deg F.

K. Angle-Type Strainers:
1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

L. Moisture/Liquid Indicators:
1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in parts per million (ppm).
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

M. Mufflers:
1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or flare.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

N. Receivers: Comply with AHRI 495.
1. Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
2. Comply with UL 207; listed and labeled by an NRTL.
3. Body: Welded steel with corrosion-resistant coating.
4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.

5. End Connections: Socket or threaded.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

O. Liquid Accumulators: Comply with AHRI 495.
1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

P. FLEXIBLE CONNECTORS
1. Corrugated stainless steel bronze hose with single layer of stainless steel exterior braiding, minimum 6 inches long with copper tube ends; for maximum working pressure 500 psi.

2.4 REFRIGERANTS

A. ASHRAE 34, R-134a: Tetrafluoroethane.

B. ASHRAE 34, R-407C: Difluoromethane/Pentafluoroethane/1,1,1,2-Tetrafluoroethane.

C. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT:

A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Safety-Relief-Valve Discharge Piping: Schedule 40, black-steel and wrought-steel fittings with welded joints or Type K or Type L, drawn-temper tubing and wrought-copper fittings with soldered joints.
1. NPS 1-1/2 and Smaller: Copper, Type L, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless or packed-angle valves on inlet and outlet side of filter dryers.

E. Install a full-size, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

L. Install receivers sized to accommodate pump-down charge.

M. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15 and in accordance the unit manufactures guidelines. Maintain refrigerant velocities within manufactures recommendations in order to keep oil entrained.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in protective conduit where installed belowground.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical damage.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Q. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

U. Install refrigerant pipping to allow expansion and contraction of piping without deformation or bending or sagging. Provide expansion fittings, bends or elbows to allow expansion in accordance with manufacturer’s temperature operating range.

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

F. Threaded Joints: Thread steel pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and to restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.

H. Welded Joints: Construct joints according to AWS D10.12M/D10.12.

I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.5 HANGERS AND SUPPORTS

A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:

1. NPS 1/2: Maximum span, 60 inches; minimum rod, 1/4 inch.

2. NPS 5/8: Maximum span, 60 inches; minimum rod, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod, 1/2 inch.

D. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2: Maximum span, 10 feet; minimum rod, 3/8 inch.
2. NPS 2-1/2: Maximum span, 11 feet; minimum rod, 3/8 inch.
3. NPS 3: Maximum span, 12 feet; minimum rod, 3/8 inch.
4. NPS 4: Maximum span, 14 feet; minimum rod, 1/2 inch.

E. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable frequency drives.

1.02 RELATED SECTIONS

A. Section 16195 - Electrical Identification: Engraved nameplates.

1.03 REFERENCES

A. Division 1 - Reference Standards: Requirements for references and standards.

B. NEMA ICS 3.1 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems.

C. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).

F. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS FOR REVIEW

A. Division 1 - Submittals: Procedures for submittals.

B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and over current protective devices, short circuit ratings, dimensions, and enclosure details.

C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

1.05 SUBMITTALS FOR INFORMATION

A. Division 1 - Submittals: Submittals for information.

B. Test Reports: Indicate field test and inspection procedures and test results.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

D. Manufacturer's Field Reports: Indicate start-up inspection findings.

1.06 SUBMITTALS FOR CLOSEOUT

A. Division 1 - Contract Closeout.

B. Operation Data: NEMA ICS 3.1. Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.

C. Maintenance Data: NEMA ICS 3.1. Include routine preventive maintenance schedule.

D. Furnish two of each air filters.

1.07 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.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Division 1 - Material and Equipment: Transport, handle, store, and protect products.

B. Accept controllers on site in original packing. Inspect for damage.

C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

1.09 MAINTENANCE SERVICE

A. Division 1 - Contract Closeout.

B. Provide service and maintenance of controller for two years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Equipment and devices can be provided by Danfoss Graham VLT 6000 Series 414-355-8800.

B. Manufacturer Qualifications: Company specializing in manufacturing variable frequency controllers with a minimum of five years documented experience, and with service facilities within 50 miles of Project.

2.02 DESCRIPTION

A. Enclosed variable frequency controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7.

B. Select unspecified features and options in accordance with NEMA ICS 3.1.

C. Furnish complete variable frequency VFDs as specified herein for the pumps designated on the drawing schedules to be variable speed. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. VFD shall be housed in a metal NEMA 1 enclosure, or other NEMA type according to the installation and operating conditions at the job site. The VFD's UL listing shall allow mounting in plenum or other air handling compartments. If a NEMA 12 enclosure is required for the plenum rating, the manufacturer must supply a NEMA 12 rated VFD. VFD's used outdoors must be in a NEMA 4x rated enclosure.

D. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.

E. With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.

F. The VFD shall include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.

G. The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL-508 certified for the building and assembly of option panels. Assembly of the option panels by a third-party panel shop is not acceptable. The appropriate UL stickers shall be applied to both the VFD and option panel, in the case where these are not contained in one panel. When these VFDs are to be located in Canada, CSA or C-UL certifications shall apply. Both VFD and option panel shall be manufactured in ISO 9001 certified facilities.

H. The VFD shall have DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VFDs without DC link reactors shall provide a minimum 3% impedance line reactor.

I. The VFD's full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.

J. The VFD shall be able to provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without derating.

K. An automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.

L. Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.

M. An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.

N. Galvanic and/or optical isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.

O. VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.

2.03 PROTECTIVE FEATURES

A. A minimum of Class 20 I^2t electronic motor overload protection for single motor applications and thermal-mechanical overloads for multiple motor applications shall be provided.

B. Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over voltage, under voltage, VFD over temperature and motor over temperature. The VFD shall display all faults in plain English. Codes are not acceptable.

C. Protect VFD from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output with an input voltage as low as 164 V AC for 208/230 volt units, and 313 V AC for 460 volt units.

D. The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.

E. VFD package shall include semi-conductor rated input fuses to protect power components.

F. To prevent breakdown of the motor winding insulation, the VFD shall be designed to comply with IEC Part 34-17. Otherwise, the VFD manufacturer must ensure that inverter rated motors are supplied.

G. VFD shall include a "signal loss detection" circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.

H. VFD shall function normally when the keypad is removed while the VFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.

I. VFD shall catch a rotating motor operating forward or reverse up to full speed.

J. VFD shall be rated for 100,000 amp interrupting capacity (AIC).

K. VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.

L. VFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230-volt VFDs, and 539 V AC on 460 volt VFDs.

M. All three pole variable frequency controllers (VFD) either integral to equipment or field supplied shall contain voltage fault protection specifically designed to protect all motors and all other 3 phase loads, and associated control circuits from failure or damage due to voltage unbalance, over/under voltage, phase loss, reversal, incorrect sequencing and rapid short cycling." The VFD shall be arranged to monitor critical faults including phase loss or reversal, and when detected, de-energize the load. It shall monitor non-critical faults including high/low voltage, voltage unbalance and when detected, after a time delay de-energize the load."

2.04 INTERFACE FEATURES

A. Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference.

B. The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.

C. The VFD shall provide digital manual speed control. Potentiometers are not acceptable.

D. Lockable, alphanumeric backlit display keypad can be remotely mounted up to 10 feet away using standard 9-pin cable.

E. The keypads for all sizes of VFDs shall be identical and interchangeable.

F. To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFD's keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters.

G. Display shall be programmable to display in 9 languages including English, Spanish and French.

H. The display shall have four lines, with 20 characters on three lines and eight large characters on one line.

I. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.

J. A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD eliminating the need for macros.

K. The VFD shall include a standard RS-485 communications port and capabilities to be connected at a future date to a Johnson Controls N2 Metasys or Siemens FLN system at no additional cost to the owner. The connection shall be software selectable by the user.

L. As a minimum, the following points shall be controlled and/or accessible:

1. VFD Start/Stop
2. Speed reference
3. Fault diagnostics
4. Meter points

    a. Motor power in HP
    b. Motor power in kW
    c. Motor kW-hr
    d. Motor current

e. Motor voltage
f. Hours run
g. Feedback signal #1
h. Feedback signal #2
i. DC link voltage
j. Thermal load on motor
k. Thermal load on VFD
l. Heat sink temperature

5. Four additional Form C 230-volt programmable relays shall be available for factory or field installation within the FD.

M. The communication protocol shall be native BACNET, LonWorks communication shall be available for factory or field installation within the VFD.

N. Two set-point control interface (PID control) shall be standard in the unit. VFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.

O. An output signal as a start command to actuate external equipment before allowing the VFD to start.

P. The following displays shall be accessible from the control panel in actual units: Reference Signal Value in actual units, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VFD Temperature in degrees, and Motor Speed in engineering units per application (in GPM, CFM, etc.). VFD will read out the selected engineering unit either in a linear, square or cubed relationship to output frequency as appropriate to the unit chosen.

Q. The display shall be programmed to read in inches of water column (in-wg) for an air handler application, pressure per square inch (psi) for a pump application, and temperature (^{o}F) for a cooling tower application.

R. VFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.

S. If the temperature of the VFD's heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VFD shall automatically reduce its output frequency to the motor. As the VFD's heat sink temperature returns to normal, the VFD shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.

T.The VFD shall have temperature-controlled cooling fans for quiet operation and minimized losses.

U. The VFD shall store in memory the last 10 faults and related operational data.

V. Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.

W. Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VFD status.

X. Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.

Y. Two programmable 0 to 20 mA analog outputs shall be provided for indication of VFD status. These outputs shall be programmable for output speed, frequency, current and power. They shall also be programmable to provide a selected 24 V DC status indication.

Z. Under fire mode conditions, the VFD shall be able to be programmed to automatically default to a preset speed.

2.05 ADJUSTMENTS

A. VFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.

B. Sixteen preset speeds shall be provided.

C. Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.

D. Four current limit settings shall be provided.

E. If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: under voltage, over voltage, current limit and inverter overload.

F. The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.

G. An automatic “on delay” may be selected from 0 to 120 seconds.

2.06 BYPASS

A. Provide a manual 3-contactor bypass consisting of a door interlocked main fused disconnect padlockable in the off position, a built-in motor starter and a four position DRIVE/OFF/BYPASS/TEST switch controlling three contactors. In the DRIVE position, the motor is operated at an adjustable speed from the VFD. In the OFF position, the motor and VFD are disconnected. In the BYPASS position, the motor is operated at full speed from the AC power line and power is disconnected from the VFD so that service can be performed. In the TEST position, the motor is operated at full speed from the AC line power while power is applied to the input of the VFD. This allows the VFD to be given an operational test while continuing to run the motor at full speed in bypass. In case of an external safety fault, a customer supplied normally closed dry contact shall be able to stop the motor whether in DRIVE or BYPASS mode.

B. Service personnel shall be able to defeat the main power disconnect and open the bypass enclosure without disconnecting power. This shall be accomplished through the use of a specially designed tool and mechanism while meeting all local and national code requirements for safety.

C. Bypass shall only be required for applications where equipment is stand alone. Such as an air handling unit or roof top AC unit. For application where redundant pumps, fans or other equipment and the standby equipment utilizes a VFD bypass is not required.

D. Bypass is not required on redundant equipment ie., pumps.

2.07 SERVICE CONDITIONS

A. Ambient temperature, -10 to 40°C (14 to 104°F).

B. 0 to 95% relative humidity, non-condensing.

C. Elevation to 3,300 feet without derating.

D. AC line voltage variation, -10 to +10% of nominal with full output.

E. No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surface is suitable for controller installation.

B. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

C. Verify that field measurements are as indicated on shop drawings and as instructed by manufacturer.

3.02 INSTALLATION

A. Section 01400 - Quality Control: Manufacturer's instructions.

B. Install in accordance with NEMA ICS 3.1.

C. Tighten accessible connections and mechanical fasteners after placing controller.

D. Provide fuses in fusible switches; refer to Section 16477 for product requirements.

E. Select and install overload heater elements in motor controllers to match installed motor characteristics.

F. Provide engraved plastic nameplates; refer to Section 16195 for product requirements and location.

G. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place in clear plastic holder.

3.03 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 7.16.2.

3.04 MANUFACTURER'S FIELD SERVICES

A. The manufacturer shall provide start-up commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system.

3.05 ADJUSTING

A. Division 1 - Contract Closeout.

B. Make final adjustments to installed controller to ensure proper operation of load system. Obtain performance requirements from installer of driven loads.

3.06 DEMONSTRATION AND INSTRUCTIONS

A. Division 1 - Contract Closeout:

B. Demonstrate operation of controllers in automatic and manual modes. Furnish 2 (1) one-hour training sessions on the project site with the owner, by factory authorized personnel.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round and flat-oval ducts and fittings.
3. Double-wall round and flat-oval ducts and fittings.
4. Sheet metal materials.
5. Duct liner.
6. Sealants and gaskets.
7. Hangers and supports.
8. Seismic-restraint devices.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Product Data: For sealants, indicating VOC content.

4. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
5. Laboratory Test Reports: For antimicrobial coatings, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment.
13. Seismic restraints, where applicable
14. Vibration isolation.

D. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints. For seismic bracing only

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: 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. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

B. Welding certificates.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

C. Construct ductwork to NFPA 90A and NFPA 90B standards. All work, materials and equipment shall comply with the latest requirements of NFPA 90A, standards and the local authorities having jurisdiction.

D. All ductwork and fan and apparatus plenums constructed and having supported in accordance with the latest standards of the ASHRAE Guide and the Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

E. Bracing, gauges, and supports indicated in SMACNA manuals are the minimum acceptable. Additional bracing or supports shall be installed to eliminate any distortion or vibration when the systems are operating or under tests.

PART 2 - PRODUCTS

2.1 General

A. General: Non-combustible or conforming to requirements for Class 1 air duct materials, or UL 181.

B. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having zinc coating of 1.25 oz per sq ft for each side in conformance with ASTM A90.

C. Dissimilar Metals: Separate connections between dissimilar metals with Dielectric Insulation. Joints between dissimilar metal duct sections to be made with Companion flanges separated by a Neoprene gasket.

D. Fasteners: Rivets, bolts, screens, and other hardware used in the sheet metal construction to be constructed of materials identical or similar to the duct material to prevent galvanic corrosion.

E. Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic as manufactured by 3M Company EC-800.

F. Hanger Rod: Steel galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Provide products from one of the following manufacturers:
1. McGill Airflow LLC
2. Zen Industries
3. Lindab
4. Spiral Manufacturing Co. Inc

B. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard." For standard applications

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

G. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B. For Humid and damp area applications including Natatoriums and Saunas.

H. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch-diameter perforations, with overall open area of 23 percent.

I. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Traverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

J. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Provide products from one of the following manufacturers:
1. McGill Airflow LLC
2. Zen Industries
3. Lindab
4. Spiral Manufacturing Co. Inc

C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

F. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.5 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. Provide products from one of the following manufacturers:
1. McGill Airflow LLC
2. Zen Industries
3. Lindab
4. Spiral Manufacturing Co. Inc

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch-diameter perforations, with overall open area of 23 percent.

E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard." For standard applications.

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

A. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B. For application in damp or humid environments including natatoriums and Saunas.

2.6 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick on sheet metal surface of ducts and fittings exposed to corrosive conditions, and minimum 1 mil thick on opposite surface.
3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.

D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

E. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

F. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

G. Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
5. Shop-Applied Coating Color: Black OR White.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

H. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

I. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.7 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

a. Maximum Thermal Conductivity:

1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Solvent Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
1. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

C. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B. For application in damp or humid environments, including natatoriums and Saunas.

D. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel, aluminum, or stainless steel to match ductwork; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

E. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.

4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.8 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
9. Service: Indoor or outdoor.
10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.9 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.10 SEISMIC-RESTRAINT DEVICES

A. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service or an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

B. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

C. Restraint Cables: ASTM A 603, galvanized or ASTM A 492, stainless-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

D. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.

E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths and with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 0 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 2 inch, plus allowance for insulation thickness and with sufficient space around equipment to allow normal operating and maintenance activities. *Provide easements where ductwork conflicts with piping and structure. Where easements exceed 10 percent duct area, split into two ducts maintaining original duct area.*

H. Provide standard 45-degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for all installations as well as fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

M. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

N. Where hanger rods must pierce ducts, provide closure plates around rods and fasten to duct using screws, rivets or welding. Seal with sealing compound.

O. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

P. Where ductwork penetrates roofs or outside walls, seal the space around ductwork airtight with fire rated expanding spray foam sealer similar to 3-M Fire Block Foam. This also applies to duct roof penetrations into roof curbs.

Q. All ductwork shall be inspected, and pressure tested prior to enclosing in general construction or concealment above hung ceilings

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system. Use clear duct sealant.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

F. Where indicated on plans, and specifically gymnasium, stage and cafeteria, Prime ductwork and paint with one coat enamel base paint. Color as per architectural plans. All ductwork surface finish shall be treated prior to priming by “pickling” in accordance with industry standards and paint manufactures requirements.

G. All ductwork in the Gymnasium, Stage, and Cafeteria shall be double wall round ductwork. Ductwork shall be primed and painted. Submit paint color chart for review and approval. Primer shall be specifically formulated for galvanized steel.

H. Duct sealants used on exposed ductwork of any type shall be clear.

3.3 DUCT SEALING

A. Seal ducts at a minimum to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible": typical for all services:

Leakage and Seal Classification Table			
System operating pressure in wc	<2" low	2"≥med<3"	High≥3"
Seal Class	C	B	A
Sealing	Transverse joints	Transverse joints and seams	Transverse joints and seams and all wall penetrations
Leakage class CL factor	24	12	4
In addition to the above, any variable air volume system duct of 1″ and ½″ wg con-struction class that is upstream of the VAV boxes shall meet Seal Class C.			

B.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

G. Where hanger rods must pierce ducts, provide closure plates around rods and fasten to duct using screws, rivets or welding. Seal with sealing compound

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems." ASCE/SEI 7.

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
2. Brace a change of direction longer than 12 feet.

Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

B. Install cables so they do not bend across edges of adjacent equipment or building structure.

C. Install cable restraints on ducts that are suspended with vibration isolators.

D. Install seismic-restraint devices using methods approved by an evaluation service member of the ICC Evaluation Service or an agency acceptable to authorities having jurisdiction.

E. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

F. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

C. Smoke purge supply and exhaust systems and stair pressure systems. Flexible connection shall be permitted at diffusers, a maximum of 3’ long, and flexible connections are permitted at air handling equipment for vibration isolation only.

D. INSULATED FLEXIBLE DUCTS
1. UL 181, Class 0, interlocking spiral of aluminum foil; fiberglass insulation; polyethylene vapor barrier film.
2. Pressure Rating: 8 inches WG positive or negative.
3. Maximum Velocity: 5000 fpm
4. Temperature Range: -20 degrees F to 250 degrees F.

3.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

a. All Ducts with a Pressure Class equal to or Higher Than 2-Inch wg: Test representative duct sections totaling no less than 25 percent of total installed duct area for each system of the designated pressure class.

b. All smoke purge system Ducts, including supply exhaust and return air. All stair pressurization ductwork. Test representative duct sections totaling no less than 50 percent of total installed duct area of each system.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

    a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.

5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 SMOKE AND HEAT DETECTOR INSTALLATION

A. Duct mounted smoke and heat detectors will be supplied under the Electrical Division. This Contractor to coordinate duct sizes and provide labor to install sensing probes into ductwork.

3.11 DUCTWORK PROTECTION

A. Duct work under construction or alteration shall not be left open ended during dust producing construction. All new and existing ductwork systems in the area of alteration or under construction shall be protected during construction. Open ends ducts shall be sealed with sheet metal or as approved.

B. For unenclosed buildings ductwork shall be kept dry and watertight. Seal open ends watertight during construction to prevent water infiltration. Keep all acoustical lining dry during construction. Lining that has become wet shall be replaced. All incomplete ductwork being used to condition spaces in phase I or phase II that will be completed under a later phase must be protected from being internally contaminated by construction dust. All returns opening must have filters placed over them to prevent dust from being returned to the unit.

3.12 DUCT SCHEDULE

A. Fabricate ducts using the following material:

1. Underground Ducts: Concrete-encased, PVC-coated, stainless steel, fiberglass
2. Natatorium ductwork – PVC coated.
3. Kitchen exhaust – welded stainless steel or black steel 18 gage.
4. Smoke purge ductwork - welded stainless steel or black steel. 18 gage.

5. Shower room exhaust – aluminum
6. Dryer exhaust – aluminum
7. Outside air intake plenum and ductwork - Aluminum
8. All exposed ductwork in any occupied area, (does not include MER), shall be constructed of double wall round or oval spiral ductwork.

B. Duct Pressure class:
1. All duct systems shall be constructed to have a pressure classification based on the maximum static pressure (positive or negative) developed by the air handling apparatus connected to the ductwork system. Unless otherwise noted below, refer to the equipment schedules and equipment notes for the design operating pressure of each system. Systems with operating pressures between pressure classes shall be constructed to the next higher-pressure class.

Pressure Classification Table						
System operating pressure (OP) in wc	OP≤1"	1"≥OP<2"	2"≥OP<3"	3"≥OP<4"	4"≥OP<6"	6"≥OP<10"
SMACNA Construction classification	1"	2"	3"	4"	6"	10"

2. All ductwork shall be constructed in accordance with the leakage and seal classification. Note that the leakage and seal classification required by current code is more stringent than SMACNA requirements.

3. The following Leakage and Seal Classification Table applies to all ductwork, supply, exhaust, or return air, rectangular, round, or oval single or double wall. Every system

Leakage and Seal Classification Table			
System operating pressure in wc	<2" low	2"≥med<3"	High≥3"
Seal Class	C	B	A
Sealing	Transverse joints	Transverse joints and seams	Transverse joints and seams and all wall penetrations
Leakage class CL factor	24	12	4
In addition to the above, any variable air volume system duct of 1″ and ½″ wg con-struction class that is upstream of the VAV boxes shall meet Seal Class C.			

C. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
2. PVC-Coated Ducts:

   a. Exposed to Airstream: Match duct material.
   b. Not Exposed to Airstream: Match duct material.

3. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

D. Liner for sound attenuation:

1. Supply, Return and exhaust air ducts: ½" inches thick.
2. Supply and return fan Plenums: 1" inches thick.
3. Transfer Ducts: 1 inch thick.
4. Ductwork downstream from VAV boxes for 15', 1" thick.
5. At the inlet and discharge of all fans for a distance of 20'

E. Double-Wall Duct Interstitial Insulation:

1. Supply, Return, Exhaust Air Ducts: 1" inches thick. (when ducts are exposed in the conditions space)
2. Supply, Return, Exhaust Air Ducts: 1 1/2" inches thick. (when ducts are concealed in plenums or are located in unconditioned spaces)

F. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with turning vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with turning vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with turning vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

    a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

        1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
        2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
        3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
        4) Radius-to Diameter Ratio: 1.5.

    b. Round Elbows, 12 Inches and Smaller in Diameter:
    c. Round Elbows, 14 Inches and Larger in Diameter:

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

    a. Rectangular Main to Rectangular Branch: 45-degree entry.
    b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

    a. Velocity 1000 fpm or Lower: 90-degree tap.
    b. Velocity 1000 to 1500 fpm: Conical tap.
    c. Velocity 1500 fpm or Higher: 45-degree lateral.

3.13 DUCTWORK PRESSURE TESTING

A. All high-pressure ductwork design or operated at 3wc or greater shall pressure tested in accordance with specification section 23 05 93 Testing Adjusting and Balancing.

B. The contractor review test report results and repair or replace any sections of ductwork with and air leakage rate over 4.0.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Ceiling radiation dampers.
7. Smoke dampers.
8. Combination fire and smoke dampers.
9. Corridor dampers.
10. Flange connectors.
11. Duct silencers.
12. Turning vanes.
13. Remote damper operators.
14. Duct-mounted access doors.
15. Flexible connectors.
16. Duct accessory hardware.
17. Duct Roof Supports

B. Related Requirements:

1. Section 233113 Metal Ducts
2. Section 233346 "Flexible Ducts" for insulated and non-insulated flexible ducts.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Sustainable Design Submittals:

1. Product data showing compliance with ASHRAE 62.1.

C. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

    a. Special fittings.
    b. Manual volume damper installations.
    c. Control-damper installations.
    d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
    e. Duct security bars.
    f. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 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. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.

C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Pottorff.
4. Ruskin Company.
5. Buckley

B. Description: Gravity balanced.

C. Maximum Air Velocity: 1000 fpm.

D. Maximum System Pressure: up to 6”wc.

E. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, 0.063-inch-thick extruded aluminum, 0.03-inch-thick stainless steel, 0.05-inch-thick stainless steel, with welded corners or mechanically attached and mounting flange.

F. Blades: Multiple single-piece blades, center pivoted, or off-center pivoted, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum or 0.050-inch-thick aluminum sheet noncombustible, tear-resistant, neoprene-coated fiberglass with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Neoprene, mechanically locked.

I. Blade Axles:

1. Material: Galvanized, steel Stainless steel, or Aluminum.
2. Diameter: 0.20 inch min.

J. Tie Bars and Brackets: Aluminum or Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball or synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.

    a. Sleeve Thickness: 20 gage minimum.
    b. Sleeve Length: 6 inches minimum.

6. Screen Mounting: Rear mounted.
7. Screen Material: Galvanized steel or Aluminum.
8. Screen Type: Bird. ½ x ½ max opening
9. 90-degree stops.

2.4 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Pottorff.
4. Ruskin Company.
5. Buckley

B. Suitable for horizontal or vertical mounting.

C. Maximum Air Velocity: 1000 fpm.

D. Maximum System Pressure: up to 6-inch wg.

E. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, 0.063-inch-thick extruded aluminum, 0.03-inch-thick stainless steel, 0.05-inch-thick stainless steel, with welded corners or mechanically attached and mounting flange.

F. Blades:

1. Multiple, 0.025-inch-thick, roll-formed aluminum or 0.050-inch-thick aluminum sheet.
2. Maximum Width: 6 inches.
3. Action: Parallel.
4. Balance: Gravity.
5. Eccentrically pivoted or Off-center pivoted.

G. Blade Seals: Neoprene.

H. Blade Axles: Galvanized steel, aluminum, or Stainless steel.

I. Tie Bars and Brackets:

1. Material: Aluminum or Galvanized steel.

2. Rattle free with 90-degree stop.

J. Return Spring: Adjustable tension.

K. Bearings: Synthetic, Stainless steel, Bronze.

L. Accessories:

1. Flange on intake.
2. Adjustment device to permit setting for varying differential static pressures.

2.5 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Flex-Tek Group.
b. McGill AirFlow LLC.
c. Nailor Industries Inc.
d. Pottorff.
e. Ruskin Company.
f. Vent Products Co., Inc.
g. Buckley

2. Standard leakage rating, with linkage outside airstream.

3. Suitable for horizontal or vertical applications.
4. Frames:

a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel or 0.05-inch-thick stainless steel.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized or Stainless-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel, Stainless or steel Nonferrous metal.
7. Bearings:

a. Oil-impregnated bronze, Molded synthetic, Oil-impregnated stainless-steel sleeve.
b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. McGill AirFlow LLC.
    b. Nailor Industries Inc.
    c. Pottorff.
    d. Ruskin Company.
    e. Vent Products Co., Inc.

2. Standard leakage rating, with linkage outside airstream.

3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
    e. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.

6. Blade Axles: Galvanized steel or Stainless steel.
7. Bearings:

    a. Oil-impregnated bronze, Molded synthetic, or Stainless-steel sleeve.
    b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Aluminum.

C. Low-Leakage, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. McGill AirFlow LLC.
    b. Nailor Industries Inc.
    c. Pottorff.
    d. Ruskin Company.
    e. Vent Products Co., Inc.

2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.
5. Frames:

    a. U or Angle shaped.
    b. 0.094-inch-thick, galvanized sheet steel or 0.05-inch-thick stainless steel.
    c. Mitered and welded corners.
    d. Flanges for attaching to walls and flangeless frames for installing in ducts.

6. Blades:

    a. Multiple or single blade.

b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized or Stainless, roll-formed steel, 0.064 inch thick.

7. Blade Axles: Galvanized steel or Stainless steel.
8. Bearings:

a. Oil-impregnated bronze, Molded synthetic, Oil-impregnated stainless-steel sleeve, Stainless-steel sleeve.
b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Blade Seals: Neoprene.
10. Jamb Seals: Cambered stainless steel or aluminum.
11. Tie Bars and Brackets: Galvanized steel or Aluminum.
12. Accessories:

a. Include locking device to hold single-blade dampers in a fixed position without vibration.

D. Low-Leakage, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. McGill AirFlow LLC.
b. Nailor Industries Inc.
c. Pottorff.
d. Ruskin Company.
e. Vent Products Co., Inc.

2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.
5. Frames: U or Angle-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
6. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
d. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.

7. Blade Axles: Galvanized steel, Stainless steel.
8. Bearings:

a. Oil-impregnated bronze, Molded synthetic, Oil-impregnated stainless-steel sleeve, Stainless-steel sleeve.
b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Blade Seals: Neoprene.
10. Jamb Seals: Cambered stainless steel, aluminum.
11. Tie Bars and Brackets: Galvanized steel, Aluminum.
12. Accessories:

a. Include locking device to hold single-blade dampers in a fixed position without vibration.

E. Jackshaft:

1. Size: 0.5-inch diameter min.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

F. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.6 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arrow United Industries.
2. Greenheck Fan Corporation.
3. McGill AirFlow LLC.
4. Nailor Industries Inc.
5. Pottorff.
6. Ruskin Company.

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

1. U or Angle shaped.
2. 0.094-inch-thick, galvanized sheet steel or 0.05-inch-thick stainless steel.
3. Mitered and welded corners.

D. Blades:

1. Multiple blade with maximum blade width of 6 inches.
2. Parallel blade for non-modulating application
3. Opposed-blade design for all modulating applications
4. Galvanized-steel, Stainless steel, Aluminum.
5. 0.064-inch-thick single skin or 0.0747-inch-thick dual skin.
6. Blade Edging: Closed-cell neoprene.
7. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

E. Blade Axles: 1/2-inch-diameter; galvanized steel, or stainless steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

F. Bearings:

1. Oil-impregnated bronze, Molded synthetic, Oil-impregnated, stainless-steel sleeve, or Stainless-steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.7 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arrow United Industries.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. Pottorff.
5. Ruskin Company.
6. Ward Industries; a brand of Hart & Cooley, Inc.

B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Curtain type with blades inside airstream for application in duct over 24” in height. Curtain type with blades outside airstream for ducts 24” or less in height. Multiple-blade type; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.138-inch up to 4 SF 0.39 over 4 SF inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.8 CEILING RADIATION DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aire Technologies.
2. Nailor Industries Inc.

3. Pottorff.
4. Prefco.
5. Ruskin Company.

B. General Requirements:

1. Labeled according to UL 555C by an NRTL.
2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.

D. Blades: Galvanized sheet steel with refractory insulation.

E. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

F. Fire Rating: 1hr for applications in assemblies up to 1 ½ hr rating. 2hr for application in assemblies of up to 3hr

2.9 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Pottorff.
4. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Smoke Detector: Integral, factory wired for single-point connection. Except for NYC smoke detector shall be provided by the fire alarm contractor.

D. Blades: Roll-formed, horizontal, overlapping, 0.063-inch- thick, galvanized sheet steel.

E. Leakage: Class I.

F. Rated pressure and velocity to exceed design airflow conditions.

G. Mounting Sleeve: Factory-installed, 0.05-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

H. Damper Motors: Modulating or two-position action.

I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: [115 V, single phase, 60 Hz].

J. Accessories:

1. Auxiliary switches for signaling, fan control and position indication.
2. Test and reset switches, damper or remote mounted.
3. Manual damper testing by physically depressing the low temperature thermal disc from the inside of the damper sleeve and resetting the sensor from the exterior side of the damper sleeve.
4. Dual position blade indicator switch package shall connect directly to the blade axel for positive annunciation (interconnecting arms, wire-forms, or brackets shall not be accepted) and provide full open and full closed blade indication to a remote location.
5. Dual Position Indicator Switch Package: Shall connect directly to the blade axel for positive annunciation (interconnecting arms, wire-forms, or brackets shall not be accepted) and provide full open and full closed blade indication to a remote location.
6. Duct Smoke Detector: Factory mounted in the damper sleeve with interconnecting wiring from the damper actuator to the smoke detector enabling a single power connection point for easy field wiring.

2.10 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Pottorff.
3. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 for assemblies upto 2 hour and 3 hr rating for assemblies over 1 1/2hours.

E. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with welded corners and mounting flange.

F. Primary heat responsive device set at 285 deg F, resettable.

G. Secondary heat closure device, set at 350 deg F, resettable.

H. Smoke Detector: Integral, factory wired for single-point connection.

I. Blades: Roll-formed, horizontal, interlocking, 0.063-inch- thick, galvanized sheet steel.

J. Leakage: Class I.

K. Rated pressure and velocity to exceed design airflow conditions.

L. Mounting Sleeve: Factory-installed, 0.039-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

M. Master control panel for use in dynamic smoke-management systems.

N. Damper Motors: Modulating or two-position action.

O. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Non-spring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 115 V, single phase, 60 Hz.

P. Accessories:

A. DRS-30 Two-Temperature Fire Closure Device:

1. UL classified two-temperature device permits the damper to be re-opened after initial temperature closure allowing the damper to remain operable for smoke management purposes until the high temperature limit is reached.

2. Manual damper testing is permitted by physically depressing the low temperature thermal disc from the inside of the damper sleeve and resetting the sensor from the exterior side of the damper sleeve.

3. Dual position blade indicator switch package shall connect directly to the blade axel for positive annunciation (interconnecting arms, wire-forms, or brackets shall not be accepted) and provide full open and full closed blade indication to a remote location.

B. PI-50 Dual Position Indicator Switch Package: Shall connect directly to the blade axel for positive annunciation (interconnecting arms, wire-forms, or brackets shall not be accepted) and provide full open and full closed blade indication to a remote location.

C. Duct Smoke Detector: Factory mounted in the damper sleeve with interconnecting wiring from the damper actuator to the smoke detector enabling a single power connection point for easy field wiring.

2.11 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CL WARD & Family Inc.
2. Ductmate Industries, Inc.
3. Hardcast, Inc.
4. Ward Industries; a brand of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.12 DUCT SILENCERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Industrial Noise Control, Inc.
2. McGill AirFlow LLC.
3. Ruskin Company.
4. Vibro-Acoustics.
5. Industrial Acoustics

B. General Requirements:

1. Factory fabricated.
2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Shape:

1. Rectangular straight with splitters or baffles.
2. Round straight with center bodies or pods.
3. Rectangular elbow with splitters or baffles.
4. Round elbow with center bodies or pods.
5. Rectangular transitional with splitters or baffles.

D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel, 0.040 inch thick.

E. Round Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel.

1. Sheet Metal Thickness for Units up to 24 Inches in Diameter: 0.034 inch thick.
2. Sheet Metal Thickness for Units 26 through 40 Inches in Diameter: 0.040 inch thick.
3. Sheet Metal Thickness for Units 42 through 52 Inches in Diameter: 0.05 inch thick.
4. Sheet Metal Thickness for Units 54 through 60 Inches in Diameter: 0.064 inch thick.

F. Inner Casing and Baffles: ASTM A 653/A 653M, G60 galvanized sheet metal, 0.034 inch thick, and with 1/8-inch-diameter perforations.

G. Special Construction:

1. Suitable for outdoor use.
2. High transmission loss to achieve STC 45.

H. Connection Sizes: Match connecting ductwork unless otherwise indicated.

I. Principal Sound-Absorbing Mechanism:

1. Controlled impedance membranes and broadly tuned resonators without absorptive media.
2. Dissipative or Film-lined type with fill material.

    a. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 15 percent compression and Moisture-proof nonfibrous material.
    b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.

3. Lining: Fiberglas cloth.

J. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.

1. Joints: Lock formed and sealed or continuously welded or flanged connections.
2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
3. Reinforcement: Cross or trapeze angles for rigid suspension.

K. Accessories:

1. Integral 1-1/2 3-hour fire damper with access door. Access door to be high transmission loss to match silencer.
2. Factory-installed end caps to prevent contamination during shipping.
3. Removable splitters.
4. Airflow measuring devices.

L. Source Quality Control: Test according to ASTM E 477.

1. Testing to be witnessed by Engineer.
2. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm face velocity.
3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

M. Capacities and Characteristics:

1. Configuration: Straight or 90-degree elbow as indicated on plan
2. Shape: Rectangular or round, as indicated on plan
3. Attenuation Mechanism: Acoustical glass fiber with protective film liner.
4. Maximum Pressure Drop: 0.25-inch wg.
5. Casing:

    a. Attenuation: Standard.
    b. Outer Material: Galvanized steel.

c. Inner Material: Galvanized steel.

6. Velocity Range: 500 fpm max.
7. End Connection: 1-inch slip joint or Flange.
8. Length: as per plan
9. Face Dimension:

   a. Width: as per plan
   b. Height: as per plan

10. Face Velocity: as per plan
11. Dynamic Insertion Loss: as per plan
12. Generated Noise: as per plan
13. Accessories:

    a. Access door.
    b. Birdscreen.

2.13 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aero-Dyne Sound Control Co.
2. CL WARD & Family Inc.
3. Ductmate Industries, Inc.
4. Duro Dyne Inc.
5. METALAIRE, Inc.
6. Ward Industries; a brand of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.14 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pottorff.
2. Ventfabrics, Inc.
3. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Copper or Aluminum.

D. Cable: Steel.

E. Wall-Box Mounting: Recessed.

F. Wall-Box Cover-Plate Material: Stainless steel.

2.15 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CL WARD & Family Inc.
2. Ductmate Industries, Inc.
3. Greenheck Fan Corporation.
4. McGill AirFlow LLC.
5. Nailor Industries Inc.
6. Pottorff.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles for plenum applications.
d. Access Doors Larger Than 24 by 48 Inches: Four hinges or Continuous and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 3.0- to 8.0-inch wg.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.

7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch-thick, fibrous-glass or polystyrene-foam board.

2.16 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. Ductmate Industries, Inc.
3. Flame Gard, Inc.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.17 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CL WARD & Family Inc.
2. Ductmate Industries, Inc.
3. Duro Dyne Inc.
4. Elgen Manufacturing.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches or 5-3/4 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd.
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.

3. Service Temperature: Minus 50 to plus 250 deg F.

G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd.
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd.
2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

I. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.18 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.19 DUCT ROOF SUPPORTS

A. Ductwork shall be supported a minimum of 12” above the roof with “H” stand manufactured by RTS. Roof support systems. All parts shall be manufactured from hot dipped galvanized steel 1 5/8” channels. All fasteners shall be hot dipped galvanized steel or nickel plated. All channels that are filed cut shall be finished with cold galvanizing at all unfinished edges. All stands shall have two lateral horizontal cross members.

B. “H” stands shall use double base. Gusseted 2”x2” square receiver base plate mounted on 14.5”x17.5” x2” think neoprene pad model RTSF21G.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Compliance with ASHRAE/IESNA 90.1-2004 includes Section 6.4.3.3.3 - "Shutoff Damper Controls," restricts the use of backdraft dampers, and requires control dampers for certain applications. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.
3. Install stainless steel volume dampers in stainless steel ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Connect ducts to duct silencers rigidly.

I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing and the bottom of all riser in laundry exhaust ducts.
8. Upstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

J. Install access doors with swing against duct static pressure.

K. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

L. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

M. Install flexible connectors to connect ducts to equipment.

N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

P. Connect diffusers or light troffer boots to ducts with maximum 30-inch lengths of flexible duct clamped or strapped in place.

Q. Connect flexible ducts to metal ducts with draw bands.

R. Install duct test holes where required for testing and balancing purposes.

S. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

T. Install remote volume damper operators for all volume dampers that are concealed an not accessible after finished construction is complete.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Utility set fans.
2. Centrifugal roof ventilators.
3. Axial roof ventilators.
4. Centrifugal wall ventilators.
5. In-line centrifugal fans.
6. Propeller fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For unit hangars and supports 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. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

D. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

E. Field quality-control reports.

F. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.6 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: 2 set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ACME Company.
   2. Central Blower Company.
   3. Greenheck Fan Corporation.
   4. Loren Cook Company.
   5. PennBarry.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

   1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector (for kitchen hood applications).
   2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Accessories:

   1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
   2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside or outside fan housing, factory wired through an internal aluminum conduit.
   3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
   4. Barometric Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
   5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

E. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

   1. Configuration: Self-flashing without a cant strip, with mounting flange.
   2. Minimum Height: 18 inches. For Kitchen exhaust applications coordinate the curb height in the field so that the top of the fan is a minimum of 40” above the roof.
   3. Sound Curb: Curb with sound-absorbing insulation.
   4. Pitch Mounting: Manufacture curb for roof slope.
   5. Metal Liner: Galvanized steel.
   6. Mounting Pedestal: Galvanized steel with removable access panel.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 15 Section "Common Motor Requirements for HVAC Equipment."

   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

B. Enclosure Type: Totally enclosed, fan cooled.

2.3 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using spring isolators or restrained spring isolators for projects with seismic requirements having a static deflection of 1 inch. Vibration- and seismic-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.

C. Install floor-mounted units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Support suspended units from structure using threaded steel rods and elastomeric hangers or spring hangers with vertical-limit stops having a static deflection of 1 inch. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section "Air Duct Accessories."

B. Kitchen exhaust hood fans shall not have flexible connections or back draft dampers.

C. Install ducts adjacent to power ventilators to allow service and maintenance.

D. Prove flexible duct connections for all fans except Kitchen exhaust fans.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

D. Comply with requirements in "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

E. Mechanical schedules and equipment notes indicate estimated static pressures and resultant RPM. If, during balancing, it is determined that the sheaves supplied with, and fan or air handling unit have reached the maximum adjustment and design static pressure and or CFM can not be obtained then it shall be the mechanical contractors responsibility to remove and change the drive as required to reach design conditions. And it shall be the balancers responsibility to rebalance the system as appropriate to achieve design conditions after the drives have been changed.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bypass, single-duct air terminal units.
2. Modulating, single-duct air terminal units.
3. Parallel fan-powered air terminal units.
4. Series fan-powered air terminal units.
5. Dual-duct air terminal units.
6. Induction air terminal units.
7. Diffuser-type air terminal units.
8. Balancing terminal units.
9. Pressure-control terminal units.
10. Critical environment control valve.
11. Underfloor air distribution terminal units.
12. Exhaust single-duct terminal units.
13. DOAS, series, fan-powered air terminal units.
14. Casing liner.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of air terminal unit.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for air terminal units.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

C. Shop Drawings: For air terminal units.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Hangers and supports, including methods for duct and building attachment [**, seismic restraints,**] and vibration isolation.

D. Delegated Design Submittal: For vibration isolation [**and supports,**] [**, and seismic restraints**] 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. Materials, fabrication, assembly, and spacing of hangers and supports.
2. Design Calculations: Calculate requirements for selecting vibration isolators [**, supports,**][**and seismic restraints**].

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and other details, or BIM model, drawn to scale, indicating the items described in this Section, and coordinated with all building trades.

B. Seismic Qualification Data: For air terminal units, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Instructions for resetting minimum and maximum air volumes.
b. Instructions for adjusting software set points.

1.5 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. Fan-Powered-Unit Filters: Furnish [**one**] <**Insert number**> spare filter(s) for each filter installed.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

1. Titus.
2. Anemostat Air Division.
3. Price Industries.
4. Nailor Industries Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a Qualified Electrical Testing Laboratory, and marked for intended location and application.

B. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, "Section 6 - Heating, Ventilating, and Air Conditioning."

D. Delegated Design: [**Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to**] design vibration isolation [**supports,**] [**and seismic restraints**], including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

E. Seismic Performance: Air terminal units shall withstand the effects of earthquake motions determined in accordance with [**ASCE/SEI 7**] <**Insert requirement**>. See Section 230548 "Vibration and Seismic Controls for HVAC."

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified[**and the unit will be fully operational after the seismic event**]."
2. Component Importance Factor: [**1.5**] [**1.0**].
3. <**Insert requirements for Component Amplification Factor and Component Response Modification Factor**>.

2.3 BYPASS, SINGLE-DUCT AIR TERMINAL UNITS

A. Description: Pressure-dependent, diverting-damper assembly inside unit casing with control components inside a protective metal shroud. Configuration enables variable volume airflow to individual zones while bypassing the unneeded air to the ceiling plenum for recirculation.

B. Casing: Minimum [**20-gauge-**] [**22-gauge-**] <**Insert dimension**> thick galvanized steel.

1. Casing Liner: Comply with requirements in "Casing Liner" Article below for [**"Casing Liner, Fibrous Glass" Paragraph**] [**"Casing Liner, Flexible Elastomeric" Paragraph**] [**with "Antimicrobial Erosion-Resistant Coating" Subparagraph**] [**with "Foil-Faced Liner" Subparagraph**] [**with "Solid Metal Liner" Subparagraph**] [**with "Perforated Metal Liner" Subparagraph**] [**with "Specialty Liner" Subparagraph**].

C. Diverter Assembly:

1. Damper, shaft, and heavy-duty self-lubricating bearings.

D. Attenuator Section: Casing material and thickness matching associated air terminal unit casing. Provide [**absorptive**] [**packless**] attenuator integral with the air terminal unit, with noise transmission loss performance as required in schedules on Drawings.

E. Hydronic Heating Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than [**0.1 inch (2.5 mm)**] [**0.08 inch (2.0 mm)**]. Include manual air vent and drain valve. Provide hydronic heating coils for air terminal units scheduled on Drawings.

F. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless steel, machine-staked terminals secured with stainless steel hardware. Provide electric-resistance heating coils for air terminal units scheduled on Drawings.

1. Stage(s): [**One**] [**Two**] [**Three**].
2. SCR controlled.
3. Access door interlocked disconnect switch.
4. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable).
5. Nickel chrome 80/20 heating elements.
6. Airflow switch for proof of airflow.
7. Fuses in terminal box for overcurrent protection (for coils of more than 48 A).
8. Pneumatic-electric switches and relays.
9. Magnetic contactor for each step of control (for three-phase coils).

G. Electric Controls:

1. Electric Damper Actuator: 24 V, [**spring-return open**] [**spring-return closed**] [**fail in last position**] [**, with microswitch to enable heating control circuit**].
2. Electric Thermostat: Wall-mounted electric type with temperature display in Fahrenheit and Celsius, and space temperature set point.
3. Air Volume Controls: Pressure-dependent volume controls with field-adjustable minimum and maximum position stops.

H. Electronic Controls:

1. Electronic Damper Actuator: 24 V, [**spring-return open**] [**spring-return closed**] [**capacitor-discharge-return open**] [**capacitor-discharge-return closed**] [**fail in last position**].
2. Electronic Thermostat: Wall-mounted electronic type with temperature display in Fahrenheit and Celsius, and space temperature set point.
3. Electronic Air Volume Controls: Pressure-dependent volume controls with field-adjustable minimum and maximum position stops.

I. Direct Digital Controls:

1. Terminal Unit Controller: Pressure-independent, VAV controller and integrated actuator, and electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes.

    a. Occupied and unoccupied operating mode.
    b. Remote reset of airflow or temperature set points.
    c. Adjusting and monitoring with portable terminal.
    d. Communication with temperature-control system specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

2. Room Sensor: Wall mounted with temperature set-point adjustment and access for connection of portable operator terminal.
3. Terminal Unit Controller, Section 230923: Controller is to be factory mounted and wired by air terminal manufacturer; unit controller, actuators, and room sensors are to be furnished under Section 230923 "Direct Digital Control (DDC) System for HVAC."

J. Control Sequence: See [**Section 230993.11 "Sequence of Operation for HVAC"**] [**Drawings**].

2.4 MODULATING, SINGLE-DUCT AIR TERMINAL UNITS

A. Description: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

B. Casing: Minimum [**20-gauge-**] [**22-gauge-**] thick galvanized steel.

1. Casing Liner: Comply with requirements in "Casing Liner" Article below for [**"Casing Liner, Fibrous Glass" Paragraph**] [**"Casing Liner, Flexible Elastomeric" Paragraph**] [**with "Antimicrobial Erosion-Resistant Coating" Subparagraph**] [**with "Foil-Faced Liner" Subparagraph**] [**with "Solid Metal Liner" Subparagraph**] [**with "Perforated Metal Liner" Subparagraph**] [**with "Specialty Liner" Subparagraph**].
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections[**, size matching inlet size**].
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.

C. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, [**1**] [**2**] percent of nominal airflow at [**3-inch wg (750-Pa)**] <**Insert value**> inlet static pressure.

D. Velocity Sensors: Multipoint array with velocity inlet sensors.

E. Attenuator Section: Casing material and thickness matching associated air terminal unit casing. Provide [**absorptive**] [**packless**] attenuator integral with the air terminal unit, with noise transmission loss performance as required in schedules on Drawings.

F. Hydronic Heating Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than [**0.1 inch (2.5 mm)**] [**0.08 inch (2.0 mm)**]. Include manual air vent and drain valve. Provide hydronic heating coils for air terminal units scheduled on Drawings.

G. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless steel, machine-staked terminals secured with stainless steel hardware. Provide electric-resistance heating coils for air terminal units scheduled on Drawings.

1. Stage(s): [**One**] [**Two**] [**Three**].
2. SCR controlled.
3. Access door interlocked disconnect switch.
4. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable).
5. Nickel chrome 80/20 heating elements.
6. Airflow switch for proof of airflow.
7. Fan interlock contacts.
8. Fuses in terminal box for overcurrent protection (for coils of more than 48 A).
9. Pneumatic-electric switches and relays.
10. Magnetic contactor for each step of control (for three-phase coils).

H. Electric Controls:

1. Electric Damper Actuator: 24 V, [**spring-return open**] [**spring-return closed**] [**fail in last position**].

2. Electric Thermostat: Wall-mounted electronic type with clock display, temperature display in Fahrenheit and Celsius, and space temperature set point.
3. Air Volume Controls: Pressure-dependent volume controls with field-adjustable minimum and maximum position stops.

I. Electronic Controls:

1. Electronic Damper Actuator: 24 V, [**spring-return open**] [**spring-return closed**] [**capacitor-discharge-return open**] [**capacitor-discharge-return closed**] [**fail in last position**].
2. Electronic Thermostat: Wall-mounted electronic type with temperature set-point display in Fahrenheit and Celsius.
3. Electronic Air Volume Controller: Pressure-independent analog electronic controller, factory calibrated and field adjustable to minimum and maximum air volumes; provides consistent airflow to the space in response to electronic thermostat signal while compensating for inlet static-pressure variations of up to 4 inches wg (1000 Pa); includes a multipoint velocity sensor at air inlet.

J. Pneumatic Controls:

1. Pneumatic Damper Actuator: [**0 to 13 psig (0 to 90 kPa)**] <**Insert range**> spring range.
2. Pneumatic Thermostat: Wall-mounted pneumatic type [**direct acting**] [**and**] [**reverse acting**] with appropriate mounting hardware.
3. Pneumatic Air Volume Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; provides consistent airflow to the space in response to pneumatic thermostat signal while compensating for inlet static-pressure variations of up to 4 inches wg (1000 Pa); includes a multipoint velocity sensor at air inlet.

K. Direct Digital Controls:

1. Terminal Unit Controller: Pressure-independent, VAV controller and integrated actuator, and electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes.

    a. Occupied and unoccupied operating mode.
    b. Remote reset of airflow or temperature set points.
    c. Adjusting and monitoring with portable terminal.
    d. Communication with temperature-control system specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

2. Room Sensor: Wall mounted with [**temperature set-point adjustment and**]access for connection of portable operator terminal.
3. Terminal Unit Controller, Section 230923: Controller is to be factory mounted and wired by air terminal manufacturer; unit controllers, integrated actuators, and room sensors to be furnished under Section 230923 "Direct Digital Controls (DDC) for HVAC."

L. Control Sequence: See [**Section 230993.11 "Sequence of Operation for HVAC"**] [**Drawings**] for control sequences.

2.5 PARALLEL FAN-POWERED AIR TERMINAL UNITS

A. Description: Volume-damper assembly and centrifugal fan in parallel arrangement inside unit casing with control components inside a protective metal shroud[**; low-profile design**].

B. Casing: Minimum [**20-gauge-**] [**22-gauge-**] thick galvanized steel.

1. Casing Liner: Comply with requirements in "Casing Liner" Article below for [**"Casing Liner, Fibrous Glass" Paragraph**] [**"Casing Liner, Flexible Elastomeric" Paragraph**] [**with "Antimicrobial Erosion-Resistant Coating" Subparagraph**] [**with "Foil-Faced Liner" Subparagraph**] [**with "Solid Metal Liner" Subparagraph**] [**with "Perforated Metal Liner" Subparagraph**] [**with "Specialty Liner" Subparagraph**].
2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
5. Fan: Forward-curved centrifugal, located at plenum air inlet.

C. Volume Damper: Galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, [**1**] [**2**] percent of nominal airflow at [**3-inch wg (750-Pa)**] <**Insert value**> inlet static pressure.

D. Velocity Sensors: Multipoint array with velocity inlet sensors.

E. Fan Motor:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Type: [**Permanent-split capacitor with SCR for speed adjustment**] [**Electronically commutated motor**].
3. Fan-Motor Assembly Isolation: Rubber isolators.
4. Enclosure: [**Open dripproof**] [**Totally enclosed, fan cooled**] <**Insert type**>.
5. Enclosure Materials: [**Cast iron**] <**Insert material**>.
6. Motor Bearings: <**Insert requirements**>.
7. Unusual Service Conditions:

    a. Ambient Temperature: <**Insert deg F (deg C)**>.
    b. Altitude: <**Insert feet (m)**> above sea level.
    c. High humidity.
    d. <**Insert conditions**>.

8. Efficiency: Premium efficient as defined in NEMA MG-1.
9. NEMA Design: <**Insert designation**>.
10. Service Factor: <**Insert value**>.
11. Motor Speed: [**Single speed**] [**Variable speed**].

    a. Speed Control: Infinitely adjustable with pneumatic-electric and electronic controls.

12. Electrical Characteristics:

    a. Horsepower: <**Insert horsepower**>.
    b. Volts: [**120**] [**208**] [**230**] [**460**] <**Insert value**>.
    c. Phase: [**Single**] [**Poly**].
    d. Hertz: 60.
    e. Full-Load Amperes: <**Insert value**>.
    f. Minimum Circuit Ampacity: <**Insert value**>.
    g. Maximum Overcurrent Protection: <**Insert amperage**>.

F. Filters:

1. Polyurethane Foam: [**MERV 3**] <**Insert value**>. Minimum efficiency reporting value and average arrestance is in accordance with ASHRAE 52.2.
2. [**Flat, Nonpleated**] [**Pleated**] Glass Fiber: Factory-fabricated, self-supported disposable air filter with holding frames. Provide [**MERV 6**] [**MERV 13**] <**Insert value**> filter with minimum efficiency reporting value is to be in accordance with ASHRAE 52.2.

G. Attenuator Section: Casing material and thickness matching associated air terminal unit casing. Provide [**absorptive**] [**packless**] attenuator integral with the [**plenum inlet**] [**and**] [**discharge outlet**] of the air terminal unit, of noise transmission loss performance as required in schedules on Drawings.

H. Hydronic Heating Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than [**0.1 inch (2.5 mm)**] [**0.08 inch (2.0 mm)**]. Include manual air vent and drain valve. Locate coil in [**plenum air inlet**] airstream. Provide hydronic heating coils for air terminal units scheduled on Drawings.

I. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless steel, machine-staked terminals secured with stainless steel hardware. Locate coil in discharge-air outlet airstream. Provide electric-resistance heating coils for air terminal units scheduled on Drawings.

1. Stage(s): [**One**] [**Two**] [**Three**].
2. SCR controlled.
3. Access door interlocked disconnect switch.
4. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable).
5. Nickel chrome 80/20 heating elements.
6. Airflow switch for proof of airflow.
7. Fan interlock contacts.
8. Fuses in terminal box for overcurrent protection (for coils of more than 48 A).
9. Pneumatic-electric switches and relays.
10. Magnetic contactor for each step of control (for three-phase coils).

J. Factory-Mounted and -Wired Controls: Electrical components mounted in control box with removable cover. Incorporate single-point electrical connection to power source.

1. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.
2. Wiring Terminations: Fan and controls to terminal strip. Terminal lugs will match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized in accordance with NFPA 70.
3. Disconnect Switch: Factory-mounted fuse type.

K. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

L. Electric Controls:

1. Electric Damper Actuator: 24 V, [**spring-return open**] [**spring-return closed**] [**fail in last position**].

2. Electric Thermostat: Wall-mounted electronic type with clock display, temperature display in Fahrenheit and Celsius, and space temperature set point.
3. Air Volume Controls: Pressure-dependent volume controls with field-adjustable minimum and maximum position stops.

M. Electronic Controls:

1. Electronic Damper Actuator: 24 V, [**spring-return open**] [**spring-return closed**] [**capacitor-discharge-return open**] [**capacitor-discharge-return closed**] [**fail in last position**].
2. Electronic Thermostat: Wall-mounted electronic type with temperature set-point display in Fahrenheit and Celsius.
3. Electronic Air Volume Controller: Pressure-independent analog electronic controller, factory calibrated and field adjustable to minimum and maximum air volumes; provides consistent airflow to the space in response to electronic thermostat signal while compensating for inlet static-pressure variations of up to 4 inches wg (1000 Pa); includes a multipoint velocity sensor at air inlet.

N. Pneumatic Controls:

1. Pneumatic Damper Actuator: [**0 to 13 psig (0 to 90 kPa)**] <**Insert range**> spring range.
2. Pneumatic Thermostat: Wall-mounted pneumatic-type, [**direct acting**] [**reverse acting**] [**direct or reverse acting as indicated on Drawings**], with appropriate mounting hardware.
3. Pneumatic Air Volume Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; provides consistent airflow to the space in response to pneumatic thermostat signal while compensating for inlet static-pressure variations of up to 4 inches wg (1000 Pa); includes a multipoint velocity sensor at air inlet.

O. Direct Digital Controls:

1. Terminal Unit Controller: Pressure-independent, VAV controller with integrated actuator and electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes.

    a. Occupied and unoccupied operating mode.
    b. Remote reset of airflow or temperature set points.
    c. Adjusting and monitoring with portable terminal.
    d. Communication with temperature-control system specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

2. Room Sensor: Wall mounted with[**temperature set-point adjustment and**] access for connection of portable operator terminal.
3. Terminal Unit Controller, Section 230923: Controller is to be factory mounted and wired by air terminal manufacturer; unit controllers, actuators, and room sensors are to be furnished under Section 230923 "Direct Digital Control (DDC) System for HVAC."

P. Control Sequence: See [**Section 230993.11 "Sequence of Operation for HVAC"**] [**Drawings**] for control sequences.

2.6 SERIES FAN-POWERED AIR TERMINAL UNITS

A. Description: Volume-damper assembly and centrifugal fan in series arrangement inside unit casing with control components inside a protective metal shroud.

1. Designed for quiet operation.
2. Low-profile design.

B. Casing: Minimum [**20-gauge-**] [**22-gauge-**] thick galvanized steel.

1. Casing Liner: Comply with requirements in "Casing Liner" Article below for [**"Casing Liner, Fibrous Glass" Paragraph**] [**"Casing Liner, Flexible Elastomeric" Paragraph**] [**with "Antimicrobial Erosion-Resistant Coating" Subparagraph**] [**with "Foil-Faced Liner" Subparagraph**] [**with "Solid Metal Liner" Subparagraph**] [**with "Perforated Metal Liner" Subparagraph**] [**with "Specialty Liner" Subparagraph**].
2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
5. Fan: Forward-curved centrifugal.

C. Volume Damper: Galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, [**1**] [**2**] percent of nominal airflow at [**3-inch wg (750-Pa)**] <**Insert value**> inlet static pressure.

D. Velocity Sensors: Multipoint array with velocity sensors in air inlet.

E. Fan Motor:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Type: [**Permanent-split capacitor with SCR for speed adjustment**] [**Electronically commutated motor**].
3. Fan-Motor Assembly Isolation: Rubber isolators.
4. Enclosure: [**Open dripproof**] [**Totally enclosed, fan cooled**] <**Insert type**>.
5. Enclosure Materials: [**Cast iron**] <**Insert material**>.
6. Motor Bearings: <**Insert requirements**>.
7. Unusual Service Conditions:

    a. Ambient Temperature: <**Insert deg F (deg C)**>.
    b. Altitude: <**Insert feet (m)**> above sea level.
    c. High humidity.
    d. <**Insert conditions**>.

8. Efficiency: Premium efficient as defined by NEMA MG-1.
9. NEMA Design: <**Insert designation**>.
10. Service Factor: <**Insert value**>.
11. Motor Speed: [**Single speed**] [**Variable speed**].

    a. Speed Control: Infinitely adjustable with pneumatic-electric and electronic controls.

12. Electrical Characteristics:

    a. Horsepower: <**Insert horsepower**>.
    b. Volts: [**120**] [**208**] [**230**] [**460**] <**Insert value**>.
    c. Phase: [**Single**] [**Poly**].
    d. Hertz: 60.

e. Full-Load Amperes: <**Insert value**>.
f. Minimum Circuit Ampacity: <**Insert value**>.
g. Maximum Overcurrent Protection: <**Insert amperage**>.

F. Filters:

1. Polyurethane Foam: [**MERV 3**] <**Insert value**>. Minimum efficiency reporting value and average arrestance in accordance with ASHRAE 52.2.
2. [**Flat, Nonpleated**] [**Pleated**] Glass Fiber: Factory-fabricated, self-supported disposable air filter with holding frames. Provide [**MERV 6**] [**MERV 13**] <**Insert value**> filters with minimum efficiency reporting value is to be in accordance with ASHRAE 522.

G. Attenuator Section: Casing material and thickness matching associated air terminal unit casing. Provide [**absorptive**] [**packless**] attenuator integral with the [**plenum inlet**] [**and**] [**discharge outlet**] of the air terminal unit, of noise transmission loss performance as required in schedules on Drawings.

H. Hydronic Heating Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than [**0.1 inch (2.5 mm)**] [**0.08 inch (2.0 mm)**]. Include manual air vent and drain valve. Locate coil in discharge outlet airstream. Provide hydronic heating coils for air terminal units scheduled on Drawings.

I. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless steel, machine-staked terminals secured with stainless steel hardware. Locate coil in discharge outlet airstream. Provide electric-resistance heating coils for air terminal units scheduled on Drawings.

1. Stage(s): [**One**] [**Two**] [**Three**].
2. SCR controlled.
3. Access door interlocked disconnect switch.
4. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable).
5. Nickel chrome 80/20 heating elements.
6. Airflow switch for proof of airflow.
7. Fan interlock contacts.
8. Fuses in terminal box for overcurrent protection (for coils of more than 48 A).
9. Pneumatic-electric switches and relays.
10. Magnetic contactor for each step of control (for three-phase coils).

J. Factory-Mounted and -Wired Controls: Electrical components mounted in control box with removable cover. Incorporate single-point electrical connection to power source.

1. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.
2. Wiring Terminations: Fan and controls to terminal strip. Terminal lugs to match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized in accordance with NFPA 70.
3. Disconnect Switch: Factory-mounted fuse type.

K. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

L. Electric Controls:

1. Electric Damper Actuator: 24 V, [**spring-return open**] [**spring-return closed**] [**fail in last position**].
2. Electric Thermostat: Wall-mounted electronic type with clock display, temperature display in Fahrenheit and Celsius[**, and space temperature set point**].
3. Air Volume Controls: Pressure-dependent volume controls with field-adjustable minimum and maximum position stops.

M. Electronic Controls:

1. Electronic Damper Actuator: 24 V, [**spring-return open**] [**spring-return closed**] [**capacitor-discharge-return open**] [**capacitor-discharge-return closed**] [**fail in last position**].
2. Electronic Thermostat: Wall-mounted electronic type with temperature display in Fahrenheit and Celsius.
3. Electronic Air Volume Controller: Pressure-independent analog electronic controller, factory calibrated and field adjustable to minimum and maximum air volumes; provides consistent airflow to the space in response to electronic thermostat signal while compensating for inlet static-pressure variations of up to 4 inches wg (1000 Pa); includes a multipoint velocity sensor at air inlet.

N. Pneumatic Controls:

1. Pneumatic Damper Actuator: [**0 to 13 psig (0 to 90 kPa)**] <**Insert range**> spring range.
2. Pneumatic Thermostat: Wall-mounted, pneumatic type, [**direct acting**] [**and**] [**reverse acting**], with appropriate mounting hardware.
3. Pneumatic Air Volume Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; provides consistent airflow to the space in response to pneumatic thermostat while compensating for inlet static-pressure variations of up to 4 inches wg (1000 Pa); includes a multipoint velocity sensor at air inlet.

O. Direct Digital Controls:

1. Terminal Unit Controller: Pressure-independent, VAV controller and integrated actuator, and electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes.

    a. Occupied and unoccupied operating mode.
    b. Remote reset of airflow or temperature set points.
    c. Adjusting and monitoring with portable terminal.
    d. Communication with temperature-control system specified in Section 230923 "Instrumentation and Control for HVAC."

2. Room Sensor: Wall mounted with[**temperature set-point adjustment and**] access for connection of portable operator terminal.
3. Terminal Unit Controller, Section 230923: Controller is to be factory mounted and wired by air terminal unit manufacturer; unit controller, actuators, and room sensors are to be furnished under Section 230923 "Direct Digital Control (DDC) for HVAC".

P. Control Sequence: See [**Section 230993.11 "Sequence of Operation for HVAC"**] [**Drawings**] for control sequences.

2.7 DUAL-DUCT AIR TERMINAL UNITS

A. Description: [**Mixing**] [**and**] [**nonmixing**] with two volume dampers inside unit casing with mixing attenuator section and control components inside a protective metal shroud.

B. Casing: Minimum [**20-gauge-**] [**22-gauge-**] thick galvanized steel.

1. Casing Liner: Comply with requirements in "Casing Liner" Article below for [**"Casing Liner, Fibrous Glass" Paragraph**] [**"Casing Liner, Flexible Elastomeric" Paragraph**] [**with "Antimicrobial Erosion-Resistant Coating" Subparagraph**] [**with "Foil-Faced Liner" Subparagraph**] [**with "Solid Metal Liner" Subparagraph**] [**with "Perforated Metal Liner" Subparagraph**] [**with "Specialty Liner" Subparagraph**].
2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.

C. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, <**Insert number**> percent of nominal airflow at [**3-inch wg (750-Pa)**] <**Insert value**> inlet static pressure.

D. Velocity Sensors: Multipoint array with velocity sensors in each air inlet and air outlet.

E. Attenuator Section: Casing material and thicknesses matching associated air terminal unit casing. Provide [**absorptive**] [**packless**] attenuator integral with the air terminal unit, of noise transmission loss performance as required in schedules on Drawings.

F. Electric Controls:

1. Electric Damper Actuator, Hot Deck: 24 V, [**spring-return open**] [**spring-return closed**] [**fail in last position**].
2. Electric Damper Actuator, Cold Deck: 24 V, [**spring-return open**] [**spring-return closed**] [**fail in last position**].
3. Electric Thermostat: Wall-mounted electronic type with clock display, temperature display in Fahrenheit and Celsius, and space temperature set point.
4. Air Volume Controls: Pressure-dependent volume controls with field-adjustable minimum and maximum position stops.

G. Electronic Controls:

1. Electronic Damper Actuator, Hot Deck: 24 V, [**spring-return open**] [**spring-return closed**] [**capacitor-discharge-return open**] [**capacitor-discharge-return closed**] [**fail in last position**].
2. Electronic Damper Actuator, Cold Deck: 24 V, [**spring- return open**] [**spring- return closed**] [**capacitor- discharge- return open**] [**capacitor- discharge- return closed**] [**fail in last position**].
3. Electronic Thermostat: Wall-mounted electronic type with temperature set-point display in Fahrenheit and Celsius.
4. Electronic Air Volume Controller: Pressure-independent analog electronic controller, factory calibrated and field adjustable to minimum and maximum air volumes; provides consistent airflow to the space in response to electronic thermostat signal while compensating for inlet static-pressure variations of up to 4 inches wg (1000 Pa); includes a multipoint velocity sensor at each air inlet.

H. Pneumatic Controls:

1. Pneumatic Damper Actuator: [**0 to 13 psig (0 to 90 kPa)**] <**Insert range**> spring range.
2. Pneumatic Thermostat: Wall-mounted pneumatic type with appropriate mounting hardware.
3. Pneumatic Air Volume Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; provides consistent airflow to the space in response to pneumatic thermostat signal while compensating for inlet static-pressure variations of up to 4 inches wg (1000 Pa); includes a multipoint velocity sensor at each air inlet.

I. Terminal Unit Controller: Pressure-independent, VAV controller with electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes.

1. Occupied and unoccupied operating mode.
2. Remote reset of airflow or temperature set points.
3. Adjusting and monitoring with portable terminal.
4. Communication with temperature-control system specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

J. Room Sensor: Wall mounted with [**temperature set-point adjustment and**]access for connection of portable operator terminal.

K. Terminal Unit Controller, Section 230923: Controllers and actuators are to be factory mounted and wired by air terminal manufacturer; unit controller, actuators, and room sensors are to be furnished under Section 230923 "Direct Digital Control (DDC) System for HVAC."

L. Control Sequence: See [**Section 230993.11 "Sequence of Operation for HVAC"**] [**Drawings**] for control sequences.

2.8 INDUCTION AIR TERMINAL UNITS

A. Description: Primary volume-damper and venturi assembly inside unit casing with mechanical induction damper mounted on casing and control components inside a protective metal shroud.

B. Casing: Minimum 22-gauge-thick galvanized steel.

1. Casing Liner: Comply with requirements in "Casing Liner" Article below for [**"Casing Liner, Fibrous Glass" Paragraph**] [**"Casing Liner, Flexible Elastomeric" Paragraph**] [**with "Antimicrobial Erosion-Resistant Coating" Subparagraph**] [**with "Foil-Faced Liner" Subparagraph**] [**with "Solid Metal Liner" Subparagraph**] [**with "Perforated Metal Liner" Subparagraph**] [**with "Specialty Liner" Subparagraph**].
2. Air Inlet: Round stub connection for duct attachment.
3. Air Outlet: S-slip and drive connections[**, size matching inlet size**].
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
5. Fan: Forward-curved centrifugal.

C. Primary Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, <**Insert number**> percent of nominal airflow at [**3-inch wg (750-Pa)**] <**Insert value**> inlet static pressure.

D. Induction Damper: Galvanized-steel, multiblade assembly with self-lubricating bearings.

E. Hydronic Heating Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than [**0.1 inch (2.5 mm)**] [**0.08 inch (2.0 mm)**]. Include manual air vent and drain valve. Provide hydronic heating coils for air terminal units scheduled on Drawings.

F. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless steel, machine-staked terminals secured with stainless steel hardware. Provide electric-resistance heating coils for air terminal units scheduled on Drawings.

1. Stage(s): [**One**] [**Two**] [**Three**].
2. SCR controlled.
3. Access door interlocked disconnect switch.
4. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable).
5. Nickel chrome 80/20 heating elements.
6. Airflow switch for proof of airflow.
7. Fan interlock contacts.
8. Fuses in terminal box for overcurrent protection (for coils of more than 48 A).
9. Pneumatic-electric switches and relays.
10. Magnetic contactor for each step of control (for three-phase coils).

G. Electric Controls:

1. Electric Damper Actuator: 24 V, [**spring-return open**] [**spring-return closed**] [**fail in last position**].
2. Electric Thermostat: Wall-mounted electronic type with clock display, temperature display in Fahrenheit and Celsius[**, and space temperature set point**].
3. Air Volume Controls: Pressure-dependent volume controls with field-adjustable minimum and maximum position stops.

H. Electronic Controls:

1. Electronic Damper Actuator: 24 V, powered open, [**spring-return open**] [**spring-return closed**] [**capacitor-discharge-return open**] [**capacitor-discharge-return closed**] [**fail in last position**].
2. Electronic Thermostat: Wall-mounted electronic type with temperature set-point display in Fahrenheit and Celsius.
3. Electronic Air Volume Controller: Pressure-independent analog electronic controller, factory calibrated and field adjustable to minimum and maximum air volumes; provides consistent airflow to the space in response to electronic thermostat signal while compensating for inlet static-pressure variations of up to 4 inches wg (1000 Pa); includes a multipoint velocity sensor at air inlet.

I. Pneumatic Controls:

1. Pneumatic Damper Actuator: [**0 to 13 psig (0 to 90 kPa)**] <**Insert range**> spring range.
2. Pneumatic Thermostat: Wall-mounted pneumatic type, [**direct acting**] [**reverse acting**] [**direct or reverse acting as indicated on Drawings**], with appropriate mounting hardware.
3. Pneumatic Air Volume Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; provides consistent airflow to the space in response to pneumatic thermostat while compensating for inlet static-pressure variations of up to 4 inches wg (1000 Pa); includes a multipoint velocity sensor at air inlet.

J. Direct Digital Controls:

1. Terminal Unit Controller: Pressure-independent, VAV controller with integrated actuator, and electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes.

    a. Occupied and unoccupied operating mode.
    b. Remote reset of airflow or temperature set points.
    c. Adjusting and monitoring with portable terminal.
    d. Communication with temperature-control system specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

2. Room Sensor: Wall mounted with temperature set-point adjustment and access for connection of portable operator terminal.
3. Terminal Unit Controller, Section 230923: Controller and actuators are to be factory mounted and wired by air terminal unit manufacturer; unit controller, actuator, and room sensors are to be furnished under Section 230923 "Direct Digital Control (DDC) System for HVAC."

K. Control Sequence: See [**Section 230993.11 "Sequence of Operation for HVAC"**] [**Drawings**] for control sequences.

2.9 DIFFUSER-TYPE AIR TERMINAL UNITS

A. Description: Volume-damper, diffuser, controller assembly[**and inlet electric heater**] and wall-mounted temperature-sensing device[**with master-drone capability**].

B. Volume Damper: [**Galvanized steel**] <**Insert material**> with peripheral gasket and self-lubricating bearings.

C. Diffuser: [**Galvanized steel**] [**Aluminum**] <**Insert material**> with [**white**] [**powder coat**] [**or**] [**baked-enamel finish**] <**Insert color and finish**>.

D. Wall-Mounted Temperature Sensor/Controller:

1. Digital display LCD wall-mounted controller.
2. Intuitive user operation.
3. Controller settings retained during power loss.
4. Communication Interface: [**BACnet**] [**Modbus**] <**Insert protocol**> compatible for integration with building automation system.
5. Operational features:

    a. Set-point indication.
    b. Set-point adjustment.
    c. Changeover temperature indication.
    d. Changeover temperature set-point adjustment.
    e. Minimum damper position adjustment for ventilation air.

E. Accessories:

1. Modular plenum-rated plug-in cables for interconnecting master-drone diffusers.
2. Blank-off panels.
3. Pressure-relief ring.
4. 24 V ac transformer/power supply for master-drone configurations.

5. Plenum-rated, plug-in, diffuser interconnection cables for master-drone configurations.
6. Diffuser back-pan insulation.
7. T-bar mounting frame.
8. Plaster ceiling frame.

F. Control Sequence: See [**Section 230993.11 "Sequence of Operation for HVAC"**] [**Drawings**] for control sequences.

2.10 BALANCING TERMINAL UNITS

A. Description: Manually operated volume-damper assembly with locking mechanism inside unit casing with multipoint, center-averaging velocity sensors[**for installation above a ceiling**].

B. Casing: Minimum 22-gauge-thick galvanized steel.

1. Leakage: Maximum 2 percent of nominal airflow at 1.5-inch wg (375-Pa) static pressure.
2. Air Inlet: Round stub connection for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Casing Liner: Comply with requirements in "Casing Liner" Article below for [**"Casing Liner, Fibrous Glass" Paragraph**] [**"Casing Liner, Flexible Elastomeric" Paragraph**] [**with "Antimicrobial Erosion-Resistant Coating" Subparagraph**] [**with "Foil-Faced Liner" Subparagraph**] [**with "Solid Metal Liner" Subparagraph**] [**with "Perforated Metal Liner" Subparagraph**] [**with "Specialty Liner" Subparagraph**].

C. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, [**2**] <**Insert number**> percent of nominal airflow at [**3-inch wg (750-Pa)**] <**Insert value**> inlet static pressure.

2.11 PRESSURE-CONTROL TERMINAL UNITS

A. Description: Volume-damper assembly inside unit casing with control components inside a protective metal shroud, designed to regulate duct pressure via throttling to control discharge pressure in a variable volume system.

B. Casing: Minimum 22-gauge-thick galvanized steel.

1. Casing Liner: Comply with requirements in "Casing Liner" Article below for [**"Casing Liner, Fibrous Glass" Paragraph**] [**"Casing Liner, Flexible Elastomeric" Paragraph**] [**with "Antimicrobial Erosion-Resistant Coating" Subparagraph**] [**with "Foil-Faced Liner" Subparagraph**] [**with "Solid Metal Liner" Subparagraph**] [**with "Perforated Metal Liner" Subparagraph**] [**with "Specialty Liner" Subparagraph**].
2. Air Inlet: Round stub connection for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to diverting damper and other parts requiring service, adjustment, or maintenance; with airtight gasket.
5. Damper Assembly: Damper, shaft, and heavy-duty self-lubricating bearings.

C. Attenuator Section: Construction materials and thicknesses matching associated air terminal unit casing. Provide [**absorptive**] [**packless**] attenuator integral with the air terminal unit, of noise transmission loss performance as required in schedules on Drawings.

D. Direct Digital Controls:

1. Terminal Unit Controller: Pressure-independent controller and integrated [**spring-return open**] [**spring-return closed**] [**capacitor-discharge-return open**] [**capacitor-discharge-return closed**] [**fail-in-last-position**] actuator, and electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum discharge pressures.

    a. Occupied and unoccupied operating mode.
    b. Remote reset of discharge pressure set points.
    c. Adjusting and monitoring with portable terminal.
    d. Communication with temperature-control system specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

2. Discharge Static Pressure Sensor: Discharge static pressure sensor to maintain constant static pressure within [**5**] <**Insert number**> percent of set point.
3. Terminal Unit Controller and Discharge Static Pressure Sensor, Section 230923: Controller, actuator, and sensor to be factory mounted and wired by air terminal manufacturer; unit controller, actuator, and sensor are to be furnished under Section 230923 "Direct Digital Control (DDC) System for HVAC."

E. Control Sequence: See [**Section 230993.11 "Sequence of Operation for HVAC"**] [**Drawings**] for control sequences.

2.12 CRITICAL ENVIRONMENT CONTROL VALVE

A. Description: Volume-damper or venturi assembly inside a unit casing with control components inside a protective metal shroud, for general exhaust applications or for exhaust applications where pressurization control via exhaust and supply airflow control is desired and airstream corrosion and contamination may be a concern.

B. Casing:

1. Material: [**Type 304 stainless steel**] [**or**] [**Type 316 stainless steel**] [**Minimum 22-gauge galvanized steel with phenolic coating**] <**Insert material**>.

C. [**Airflow Metering, Option: Calibrated shaft position with self-adjusting, spring-loaded cone.**]

D. [**Sensors, Option: Multipoint,**] [**Type 316 stainless steel**] <**Insert material**> [**, removable**].

E. Direct Digital Controls:

1. Terminal Unit Controller, Section 230923: Controller is to be factory mounted and wired by air terminal manufacturer; unit controller, actuators, and room sensors are to be furnished under Section 230923 "Direct Digital Control (DDC) System for HVAC."

F. Control Sequence: See [**Section 230993.11 "Sequence of Operation for HVAC"**] [**Drawings**] for control sequences.

2.13 UNDERFLOOR AIR DISTRIBUTION TERMINAL UNITS

A. Description: Volume-damper assembly and fan in series arrangement inside low-profile unit casing with control components inside a protective metal shroud within a raised access floor. Design configuration for [**pressurized floor cavity supply**] [**and**] [**ducted air supply**].

B. Casing: Minimum [**20-gauge-**] [**22-gauge-**] thick galvanized steel.

1. Integral floor discharge diffusers.
2. Mixing damper.
3. VAV throttling damper.
4. Leveling feet.
5. Casing Liner: Comply with requirements in "Casing Liner" Article below for [**"Casing Liner, Fibrous Glass" Paragraph**] [**"Casing Liner, Flexible Elastomeric" Paragraph**] [**with "Antimicrobial Erosion-Resistant Coating" Subparagraph**] [**with "Foil-Faced Liner" Subparagraph**] [**with "Solid Metal Liner" Subparagraph**] [**with "Perforated Metal Liner" Subparagraph**] [**with "Specialty Liner" Subparagraph**].
6. Air Outlet: S-slip and drive connections.
7. Access: Removable panels on top of casing, for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
8. Fan: Forward-curved centrifugal [**in double blower configuration**] [**with double blowers as scheduled**].

C. Volume Damper: Galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, [**1**] [**2**] percent of nominal airflow at [**3-inch wg (750-Pa)**] <**Insert value**> inlet static pressure.
2. Damper Position: Normally [**open**] [**closed**].

D. Velocity Sensors: Multipoint array with velocity sensors in air inlets.

E. Motor:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Type: [**Permanent-split capacitor with SCR for speed adjustment**] [**Electronically commutated motor**].
3. Fan-Motor Assembly Isolation: Rubber isolators.
4. Enclosure: [**Open dripproof**] [**Totally enclosed, fan cooled**] <**Insert type**>.
5. Enclosure Materials: [**Cast iron**] <**Insert material**>.
6. Motor Bearings: <**Insert requirements**>.
7. Unusual Service Conditions:

    a. Ambient Temperature: <**Insert deg F (deg C)**>.
    b. Altitude: <**Insert feet (m)**> above sea level.
    c. High humidity.
    d. <**Insert conditions**>.

8. Efficiency: Premium efficient.
9. NEMA Design: <**Insert designation**>.
10. Service Factor: <**Insert value**>.
11. Motor Speed: [**Single speed**] [**Variable speed**].
12. Electrical Characteristics:

    a. Horsepower: <**Insert horsepower**>.
    b. Volts: [**120**] [**208**] [**230**] [**460**] <**Insert value**>.
    c. Phase: [**Single**] [**Poly**].
    d. Hertz: 60.
    e. Full-Load Amperes: <**Insert value**>.

f. Minimum Circuit Ampacity: <**Insert value**>.
g. Maximum Overcurrent Protection: <**Insert amperage**>.

F. Hydronic Heating Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than [**0.1 inch (2.5 mm)**] [**0.08 inch (2.0 mm)**]. Include manual air vent and drain valve. Locate coil in discharge outlet airstream. Provide hydronic heating coils for air terminal units scheduled on Drawings.

G. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless steel, machine-staked terminals secured with stainless steel hardware. Locate coil in discharge outlet airstream. Provide electric-resistance heating coils for air terminal units scheduled on Drawings.

1. Stage(s): [**One**] [**Two**] [**Three**].
2. SCR controlled.
3. Access door interlocked disconnect switch.
4. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable).
5. Nickel chrome 80/20 heating elements.
6. Airflow switch for proof of airflow.
7. Fan interlock contacts.
8. Fuses in terminal box for overcurrent protection (for coils of more than 48 A).
9. Pneumatic-electric switches and relays.
10. Magnetic contactor for each step of control (for three-phase coils).

H. Factory-Mounted and -Wired Controls: Electrical components mounted in control box with removable cover. Incorporate single-point electrical connection to power source.

1. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.
2. Wiring Terminations: Fan and controls to terminal strip. Verify terminal lugs match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized in accordance with NFPA 70.
3. Disconnect Switch: Factory-mounted fuse type.

I. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

J. Electronic Controls:

1. Electronic Damper Actuator: 24 V, [**spring-return open**] [**spring-return closed**] [**capacitor-discharge-return open**] [**capacitor-discharge-return closed**] [**fail in last position**].
2. Electronic Thermostat: Wall-mounted electronic type with temperature set-point display in Fahrenheit and Celsius.
3. Electronic Air Volume Controller: Pressure-independent analog electronic controller, factory calibrated and field adjustable to minimum and maximum air volumes; provides consistent airflow to the space in response to electronic thermostat signal while compensating for inlet static-pressure variations of up to 4 inches wg (1000 Pa); includes a multipoint velocity sensor at air inlet.

K. Direct Digital Controls:

1. Terminal Unit Controller: Pressure-independent, VAV controller with integrated actuator and electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes.

    a. Occupied and unoccupied operating mode.
    b. Remote reset of airflow or temperature set points.
    c. Adjusting and monitoring with portable terminal.
    d. Communication with temperature-control system specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

2. Room Sensor: Set-point adjustment and access for connection of portable operator terminal.
3. Terminal Unit Controller, Section 230923: Controller is to be factory mounted and wired by air terminal manufacturer; unit controller, actuators, and room sensors are to be furnished under Section 230923 "Direct Digital Control (DDC) System for HVAC."

L. Control Sequence: See [**Section 230993.11 "Sequence of Operation for HVAC"**] [**Drawings**] for control sequences.

2.14 EXHAUST SINGLE-DUCT TERMINAL UNITS

A. Description: Volume-damper assembly inside unit casing with control components inside a protective metal shroud, for exhaust applications where pressurization control via exhaust and supply airflow control is desired.

B. Casing: Minimum [**22-gauge-**] [**20-gauge-**] <**Insert value**> thick galvanized steel.

1. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
2. Air Outlet: S-slip and drive connections[**, size matching inlet size**].
3. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.

C. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, [**1**] [**2**] percent of nominal airflow at [**3-inch wg (750-Pa)**] <**Insert value**> inlet static pressure.

D. Attenuator Section: Casing material and thickness matching associated air terminal unit casing. Provide [**absorptive**] [**packless**] attenuator integral with the air terminal unit, of noise transmission loss performance as required in schedules on Drawings.

E. Electric Controls:

1. Damper Actuator: 24 V, [**spring-return open**] [**spring-return closed**] [**fail in last position**].
2. Air Volume Controls: Pressure-dependent volume controls with field-adjustable minimum and maximum position stops.
3. Differential Pressure Sensor: Wall-mounted type with set point.

F. Electronic Controls:

1. Damper Actuator: 24 V, [**spring-return open**] [**spring-return closed**] [**capacitor-discharge-return open**] [**capacitor-discharge-return closed**] [**fail in last position**].
2. Electronic Air Volume Controller: Pressure-independent analog electronic controller, factory calibrated and field adjustable to minimum and maximum air volumes; provides consistent airflow to the space in response to electronic thermostat signal while compensating for inlet static-pressure variations of up to 4 inches wg (1000 Pa); includes a multipoint velocity sensor at air inlet.
3. Differential Pressure Sensor: Wall-mounted electronic type with set-point display.

G. Direct Digital Controls:

1. Terminal Unit Controller: Pressure-independent, controller and integrated [**spring-return open**] [**spring-return closed**] [**capacitor-discharge open**] [**capacitor-discharge-return closed**] [**fail-in-last-position**] actuator, and electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes.

    a. Occupied and unoccupied operating mode.
    b. Remote reset of airflow or temperature set points.
    c. Adjusting and monitoring with portable terminal.
    d. Communication with temperature-control system specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

2. Room Sensor: Wall mounted with differential pressure set-point adjustment[**and access for connection of portable operator terminal**].
3. Terminal Unit Controller, Section 230923: Controller is to be factory mounted and wired by air terminal manufacturer; unit controller, actuators, and room sensors are to be furnished under Section 230923 "Direct Digital Control (DDC) System for HVAC."
4. Damper Actuator: 24 V, [**spring-return open**] [**spring-return closed**] [**capacitor-discharge-return open**] [**capacitor-discharge-return closed**] [**fail in last position**].

H. Control Sequence: See [**Section 230993.11 "Sequence of Operation for HVAC"**] [**Drawings**] for control sequences.

2.15 DOAS, SERIES, FAN-POWERED AIR TERMINAL UNITS

A. Description: Primary outside-air volume-damper assembly and fan in series arrangement inside unit casing, with control components inside a protective metal shroud, with chilled-water coil for sensible cooling.

B. Casing: Minimum [**20-gauge-**] [**22-gauge-**] thick galvanized steel.

1. Casing Liner: Comply with requirements in "Casing Liner" Article below for [**"Casing Liner, Fibrous Glass" Paragraph**] [**"Casing Liner, Flexible Elastomeric" Paragraph**] [**with "Antimicrobial Erosion-Resistant Coating" Subparagraph**] [**with "Foil-Faced Liner" Subparagraph**] [**with "Solid Metal Liner" Subparagraph**] [**with "Perforated Metal Liner" Subparagraph**] [**with "Specialty Liner" Subparagraph**].
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections[**, size matching inlet size**].
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.

C. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, [**1**] [**2**] percent of nominal airflow at [**3-inch wg (750-Pa)**] <**Insert value**> inlet static pressure.

D. Velocity Sensors: Multipoint array with velocity inlet sensors.

E. Fan Motor:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Type: [**Permanent-split capacitor with SCR for speed adjustment**] [**Electronically commutated motor**].
3. Fan-Motor Assembly Isolation: Rubber isolators.
4. Enclosure: [**Open dripproof**] [**Totally enclosed, fan cooled**] <**Insert type**>.
5. Enclosure Materials: [**Cast iron**] <**Insert material**>.
6. Motor Bearings: <**Insert requirements**>.
7. Unusual Service Conditions:

    a. Ambient Temperature: <**Insert deg F (deg C)**>.
    b. Altitude: <**Insert feet (m)**> above sea level.
    c. High humidity.
    d. <**Insert conditions**>.

8. Efficiency: Premium efficient as defined in NEMA MG-1.
9. NEMA Design: <**Insert designation**>.
10. Service Factor: <**Insert value**>.
11. Motor Speed: [**Single speed**] [**Variable speed**].

    a. Speed Control: Infinitely adjustable with pneumatic-electric and electronic controls.

12. Electrical Characteristics:

    a. Horsepower: <**Insert horsepower**>.
    b. Volts: [**120**] [**208**] [**230**] [**460**] <**Insert value**>.
    c. Phase: [**Single**] [**Poly**].
    d. Hertz: 60.
    e. Full-Load Amperes: <**Insert value**>.
    f. Minimum Circuit Ampacity: <**Insert value**>.
    g. Maximum Overcurrent Protection: <**Insert amperage**>.

F. Filters:

1. Polyurethane Foam: [**MERV 3**] <**Insert value**>. Minimum efficiency reporting value and average arrestance in accordance with ASHRAE 52.2.
2. [**Flat, Nonpleated**] [**Pleated**] Glass Fiber: Factory-fabricated, self-supported disposable air filter with holding frames. Provide [**MERV 6**] [**MERV 13**] <**Insert value**> filter with minimum efficiency reporting value in accordance with ASHRAE 52.2.

G. Attenuator Section: Casing material and thickness matching associated air terminal unit casing. Provide [**absorptive**] [**packless**] attenuator integral with the air terminal unit, of noise transmission loss performance as required in schedules on Drawings.

H. Hydronic Heating Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than [**0.1 inch (2.5 mm)**] [**0.08 inch (2.0 mm)**]. Include manual air vent and drain valve. Provide hydronic heating coils for air terminal units scheduled on Drawings.

I. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless steel, machine-staked terminals secured with stainless steel hardware. Provide electric-resistance heating coils for air terminal units scheduled on Drawings.

1. Stage(s): [**One**] [**Two**] [**Three**].
2. SCR controlled.
3. Access door interlocked disconnect switch.
4. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable).
5. Nickel chrome 80/20 heating elements.
6. Airflow switch for proof of airflow.
7. Fan interlock contacts.
8. Fuses in terminal box for overcurrent protection (for coils of more than 48 A).
9. Pneumatic-electric switches and relays.
10. Magnetic contactor for each step of control (for three-phase coils).

J. Hydronic Cooling Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than [**0.1 inch (2.5 mm)**] [**0.08 inch (2.0 mm)**]. Include manual air vent and drain valve. Locate cooling coils at plenum air inlet. Include galvanized-steel factory-installed drip tray [**and moisture sensor**]for safety in cases where cooling coil temporarily experiences nondesign conditions.

K. Factory-Mounted and -Wired Controls: Electrical components mounted in control box with removable cover. Incorporate single-point electrical connection to power source.

1. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.
2. Wiring Terminations: Fan and controls to terminal strip. Terminal lugs to match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized in accordance with NFPA 70.
3. Disconnect Switch: Factory-mounted fuse type.

L. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

M. Electric Controls:

1. Electric Damper Actuator: 24 V, [**spring-return open**] [**spring-return closed**] [**fail in last position**].
2. Electric Thermostat: Wall-mounted electronic type with clock display, temperature display in Fahrenheit and Celsius, and space temperature set point.
3. Air Volume Controls: Pressure-dependent volume controls with field-adjustable minimum and maximum position stops.

N. Electronic Controls:

1. Electronic Damper Actuator: 24 V, [**spring-return open**] [**spring-return closed**] [**capacitor-discharge-return open**] [**capacitor-discharge-return closed**] [**fail in last position**].
2. Electronic Thermostat: Wall-mounted electronic type with temperature display in Fahrenheit and Celsius.

3. Electronic Air Volume Controller: Pressure-independent analog electronic controller, factory calibrated and field adjustable to minimum and maximum air volumes; provides consistent airflow to the space in response to electronic thermostat signal while compensating for inlet static-pressure variations of up to 4 inches wg (1000 Pa); includes a multipoint velocity sensor at air inlet.

O. Pneumatic Controls:

1. Pneumatic Damper Actuator: [**0 to 13 psig (0 to 90 kPa)**] <**Insert range**> spring range.
2. Pneumatic Thermostat: Wall-mounted, pneumatic type, [**direct acting**] [**and**] [**reverse acting**], with appropriate mounting hardware.
3. Pneumatic Air Volume Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; provides consistent airflow to the space in response to pneumatic thermostat signal while compensating for inlet static-pressure variations of up to 4 inches wg (1000 Pa); includes a multipoint velocity sensor at air inlet.

P. Direct Digital Controls:

1. Terminal Unit Controller: Pressure-independent, VAV controller with integrated actuator and electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes.

    a. Occupied and unoccupied operating mode.
    b. Remote reset of airflow or temperature set points.
    c. Adjusting and monitoring with portable terminal.
    d. Communication with temperature-control system specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

2. Room Sensor: Wall mounted with temperature set-point adjustment and access for connection of portable operator terminal.
3. Terminal Unit Controller, Section 230923: Controller is to be factory mounted and wired by air terminal manufacturer; unit controller, actuators, and room sensors are to be furnished under Section 230923 "Direct Digital Control (DDC) System for HVAC."
4. Cooling Coil Drip Pan Sensor: Shuts off fan upon detection of moisture in drip pan.

Q. Control Sequence: See [**Section 230993.11 "Sequence of Operation for HVAC"**] [**Drawings**] for control sequences.

2.16 CASING LINER

A. Casing Liner, Fibrous Glass: Fibrous-glass duct liner, complying with ASTM C1071, NFPA 90A or NFPA 90B, and with NAIMA AH124.

1. Minimum Thickness: [**1/2 inch (13 mm)**] [**3/4 inch (19 mm)**] [**1 inch (25 mm)**].

    a. Maximum Thermal Conductivity:

        1) Type I, Flexible: [**0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K)**] <**Insert value**> at 75 deg F (24 deg C) mean temperature.
        2) Type II, Rigid: [**0.23 Btu x in./h x sq. ft. x deg F (0.033 W/m x K)**] <**Insert value**> at 75 deg F (24 deg C) mean temperature.

2. Antimicrobial Erosion-Resistant Coating: Apply to surface of liner that will form interior surface of duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial

compound is to be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

3. Foil-Faced Liner: Minimum 0.001-inch (0.03-mm) reinforced, nonporous aluminum foil applied to matted insulation airstream face. [**Encapsulate all insulation edges with sheet metal angles and channels, or tape.**]
4. Solid Metal Liner: Solid [**galvanized sheet metal**] <**Insert material**> encapsulating matted insulation face from airstream.
5. Perforated Metal Liner: Perforated [**galvanized sheet metal**] <**Insert material**> encapsulating matted insulation face from airstream.
6. Specialty Liner: <**Insert specialty liner in coordination with manufacturers**>.
7. [**Solvent**] [**Water**]-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.

B. Casing Liner, Flexible Elastomeric: Flexible elastomeric duct liner fabricated of preformed, cellular, closed-cell, sheet materials complying with ASTM C534/C534M, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Minimum Thickness: [**1/2 inch (13 mm)**] <**Insert dimension**>.
2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

2.17 CE QUALITY CONTROL

A. [**AHRI 880 Certification: Test, rate, and label assembled air terminal units in accordance with AHRI 880.**]

B. [**AHRI 880: Test and rate assembled air terminal units in accordance with AHRI 880.**]

C. Water Coils: Factory pressure test to 300 psig (2070 kPa) in accordance with AHRI 410 and ASHRAE 33.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with Section 230529 "Hangers and Supports for HVAC Piping and Equipment" and Section 233113 "Metal Ducts" for hangers and supports.

B. Install air terminal units according to NFPA 90A.

C. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

D. Install wall-mounted thermostats.

3.2 PIPING CONNECTIONS

A. Where installing piping adjacent to air terminal unit, allow space for service and maintenance.

B. Hot-Water [**and**] [**Chilled-Water**] Piping: Comply with requirements in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties," and connect heating [**and**] [**cooling**] coils to supply piping with shutoff valve, strainer, control valve, and union or flange; and to return piping with balancing valve and union or flange.

3.3 DUCTWORK CONNECTIONS

A. Comply with requirements in [**Section 233113 "Metal Ducts"**] [**Section 233116 "Nonmetal Ducts"**] for connecting ducts to air terminal units.

B. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."

3.4 ELECTRICAL CONNECTIONS

A. Install field power to each air terminal unit electrical power connection. Coordinate with air terminal unit manufacturer and installers.

B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

D. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

E. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least [**1/2 inch (13 mm)**] <**Insert dimension**> high.

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.6 IDENTIFICATION

A. Label each air terminal unit with drawing designation, nominal airflow, maximum and minimum factory-set airflows[**, and coil type**]. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.7 STARTUP SERVICE

A. [**Engage a factory-authorized service representative to perform**] [**Perform**] startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
3. Verify that controls and control enclosure are accessible.
4. Verify that control connections are complete.
5. Verify that nameplate and identification tag are visible.
6. Verify that controls respond to inputs as specified.
7. <**Insert startup steps if any**>.

3.8 ADJUSTING

A. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air terminal unit testing, adjusting, and balancing.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: [**Owner**] [**Contractor**] will engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections [**with the assistance of a factory-authorized service representative**]:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Air terminal unit will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 DEMONSTRATION

A. [**Engage a factory-authorized service representative to train**] [**Train**] Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Rectangular and square ceiling diffusers.
   2. Perforated diffusers.
   3. Louver face diffusers.

B. Related Requirements:

   1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
   2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.
   3. Section 233713.43 "Security Registers and Grilles" for security registers and security grilles.
   4. Section 233716 "Fabric Air-Diffusion Devices" for continuous tubular diffusers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 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 assembly members.
   2. Method of attaching hangers to building structure.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 RECTANGULAR AND SQUARE CEILING DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anemostat Air Distribution; Anemostat, Inc.; Mestek, Inc.
2. Krueger-HVAC; brand of Johnson Controls International plc, Global Products.
3. Nailor Industries Inc.
4. Price Industries Limited.
5. Titus; brand of Johnson Controls International plc, Global Products.

B. Devices shall be specifically designed for variable-air-volume flows.

C. Material: Steel.

D. Finish: Baked enamel, white.

E. Face Size: 24 by 24 inches (600 by 600 mm).

F. Face Style: Plaque.

G. Mounting: T-bar.

H. Pattern: Adjustable.

I. Dampers: Radial opposed blade.

J. Accessories:

1. Equalizing grid.
2. Plaster ring.
3. Safety chain.
4. Wire guard.
5. Sectorizing baffles.
6. Operating rod extension.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

3.2 INSTALLATION

A. Install diffusers level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Fixed face registers and grilles.

B. Related Requirements:

   1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
   2. Section 233713.13 "Air Diffusers" for various types of air diffusers.
   3. Section 233713.43 "Security Registers and Grilles" for security registers and security grilles.
   4. Section 233716 "Fabric Air-Diffusion Devices" for continuous tubular diffusers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 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 assembly members.
   2. Method of attaching hangers to building structure.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 GRILLES

A. Fixed Face Grille:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anemostat Air Distribution; Anemostat, Inc.; Mestek, Inc.
   b. Krueger-HVAC; brand of Johnson Controls International plc, Global Products.
   c. Nailor Industries Inc.
   d. Price Industries Limited.
   e. Titus; brand of Johnson Controls International plc, Global Products.

2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal; spaced 3/4 inch (19 mm) apart.
5. Core Construction: Removable.
6. Frame: 1 inch (25 mm) wide.
7. Mounting: Lay in.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

3.2 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes heat wheels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For air-to-air energy recovery equipment.

1. Include plans, elevations, sections, details, and mounting attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For air-to-air energy recovery equipment 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. Detail fabrication and assembly of air-to-air energy recovery equipment.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
3. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Mechanical-room layout and relationships between components and adjacent structural and mechanical elements.
2. Support location, type, and weight.
3. Field measurements.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-to-air energy recovery equipment to include in maintenance manuals.

1.6 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. Wheel Belts: One set of belts for each heat wheel.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of air-to-air energy recovery equipment that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.

C. ASHRAE Compliance:

1. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
2. Capacity ratings for air-to-air energy recovery equipment shall comply with ASHRAE 84, "Method of Testing Air-to-Air Heat/Energy Exchangers."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

E. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design vibration isolation, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

2.2 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. AIRotor, LLC.
2. Airxchange Inc.
3. Desiccant Rotors International, Inc.
4. Heatex, Inc.
5. Klingenburg.
6. Novelaire Technologies.
7. SEMCO, LLC; part of FlaktGroup.
8. Systemair.

B. Source Limitations: Obtain from single source from single manufacturer.

2.3 HEAT WHEELS

A. Casing:

1. Galvanized steel, stainless steel, or aluminum with standard factory finish.
2. Integral purge section limiting carryover of exhaust air to between 0.05 percent at 1.6-inch wg and 0.20 percent at 4-inch wg differential pressure.
3. Casing seals on periphery of rotor and on duct divider and purge section.
4. Support vertical rotors on grease-lubricated ball bearings having extended grease fittings or permanently lubricated bearings with an L-10 400,000 hours. Support horizontal rotors on tapered roller bearing.

B. Rotor: Aluminum or polymer segmented wheel strengthened with radial spokes, with nontoxic, noncorrosive, silica-gel desiccant coating.

C. Drive: Fractional horsepower motor and gear reducer, with speed changed by variable-frequency controller and self-adjusting multilink belt around outside of rotor.

1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

D. Controls:

1. Starting relay, factory mounted and wired, and manual motor starter for field wiring.
2. Variable-Frequency Controller with Exhaust- and Outdoor-Air Sensors: Factory mounted and wired, with exhaust- and outdoor-air sensors, automatic changeover thermostat and set-point adjuster, to vary rotor speed and maintain exhaust temperature above freezing and air differential temperature above set point. Rotor speed shall increase to maximum when exhaust-air temperature is less than outdoor-air temperature.
3. Pilot-Light Indicator: Display rotor rotation and speed.
4. Speed Settings: Adjustable settings for maximum and minimum rotor speed limits.

2.4 SOURCE QUALITY CONTROL

A. AHRI 1060 Certification: Testing according to AHRI 1060 and listed and labeled by AHRI.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical services to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF HEAT WHEELS

A. Install heat wheels so supply and exhaust airstreams flow in opposite directions and rotation is away from exhaust side to purge section to supply side.

1. Install access doors in both supply and exhaust ducts, both upstream and downstream, for access to wheel surfaces, drive motor, and seals.
2. Install removable panels or access doors between supply and exhaust ducts on building side for bypass during startup.
3. Access doors and panels are specified in Section 233300 "Air Duct Accessories."

B. Install floor-mounted units on 4-inch- (100-mm-) high concrete base designed to withstand, without damage to equipment, seismic force required by code.

C. Equipment Mounting:

1. Install air-to-air energy recovery equipment on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

D. Install units with clearances for service and maintenance.

E. Comply with requirements for ductwork specified in Section 233113 "Metal Ducts."

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
   1. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch (13 mm) high.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   2. Adjust seals and purge.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   4. Set initial temperature and humidity set points.
   5. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

D. Air-to-air energy recovery equipment will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Perform startup service.

   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Verify that shipping, blocking, and bracing are removed.
   3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
   4. Verify proper motor rotation direction, wheel rotation, and smooth bearing operations. Reconnect motor drive system, align belts, and install belt guards.
   5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.

3.7 ADJUSTING

A. Comply with requirements for air-handling system testing, adjusting, and balancing in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air-to-air energy recovery units.

END OF SECTION 237213

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 packaged, large-capacity, rooftop air conditioning units (RTUs) with the following components:

1. Casings.
2. Fans, drives, and motors.
3. Rotary heat exchanger.
4. Coils.
5. Refrigerant circuit components.
6. Air filtration.
7. Gas furnaces.
8. UV germicidal irradiation section.
9. Sound-attenuator section.
10. Dampers.
11. Electrical power connections.
12. Controls.
13. Roof curbs.
14. Accessories.

1.3 DEFINITIONS

A. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, large-capacity, rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

1.4 ACTION SUBMITTALS

A. Product Data: For each RTU.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
3. Include unit dimensions and weight.
4. Include cabinet material, metal thickness, finishes, insulation, and accessories.
5. Fans:

    a. Include certified fan-performance curves with system operating conditions indicated.
    b. Include certified fan-sound power ratings.
    c. Include fan construction and accessories.

d. Include motor ratings, electrical characteristics, and motor accessories.

6. Include certified coil-performance ratings with system operating conditions indicated.
7. Include filters with performance characteristics.
8. Include gas furnaces with performance characteristics.
9. Include factory selection calculations for each antimicrobial ultraviolet lamp installation.
10. Include dampers, including housings, linkages, and operators.

B. Shop Drawings: For each packaged, large-capacity, rooftop air-conditioning units.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For RTU supports 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. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.
2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and other details, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Sample Warranty: For manufacturer's warranty.

C. Source quality-control reports.

D. System startup reports.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) of filters for each unit.
2. Gaskets: One set(s) for each access door.
3. Fan Belts: One set(s) for each belt-driven fan.

1.8 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of outdoor, semi-custom, air-handling unit that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 1 year(s) from date of Substantial Completion.
2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of RTUs and components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE 15 Compliance: For refrigeration system safety.

E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design mounting and restraints for RTUs, including comprehensive engineering analysis.

2.2 CAPACITIES AND CHARACTERISTICS

A. Supply-Air Fan:

1. Fan Type: Belt-driven, double width, forward curve, centrifugal.
2. Airflow: See plans.
3. External Static Pressure: See plans.
4. Fan Speed: **Variable**.
5. Motor Horsepower: See plans.

B. Relief (Exhaust)-Air Fan:

1. Airflow: See plans.
2. External Static Pressure: See plans.
3. Fan Speed: See plans.
4. Motor Horsepower: See plans.
5. Motor Speed: See plans.

C. Motors:

1. Service Factor: 1.15.

2. Motor Bearings: Sealed and permanently lubricated.

3. Efficiency: Premium efficient.

D. Supply-Air Refrigerant Coil:

1. Total Cooling Capacity: See plans.
2. Sensible Cooling Capacity: See plans.
3. Entering-Air Dry-Bulb Temperature: See plans.
4. Entering-Air Wet-Bulb Temperature: See plans.
5. Refrigerant Type: See plans.

E. Supply-Air Hot-Water Coil:

1. Coil Face Dimensions:

a. Finned Length: See plans.
b. Finned Width: See plans.

2. Minimum Fin Spacing: See plans.
3. Tube Diameter: See plans.
4. Number of Rows: See plans.
5. Air Side:

a. Flow Rate: See plans.
b. Finned Area Face Velocity: See plans.
c. Static Pressure Drop: See plans.
d. Total Capacity: See plans.
e. Entering Temperature: See plans.
f. Leaving Temperature: See plans.

6. Water Side:

a. Flow Rate: See plans.
b. Tube Velocity: See plans.
c. Glycol Type: See plans.
d. Aqueous Glycol Solution Concentration: See plans.
e. Pressure Drop: See plans.
f. Entering Temperature: See plans.
g. Leaving Temperature: See plans.

F. Hot-Gas Reheat Coil: See plans.

G. Recirculating-Air Filters:

1. Type: Pleated.
2. Face Dimensions, each: See plans.
3. Depth: 2”.
4. Number of Filters in Filter Bank: Per manufacturer.
5. Access Location: Side.
6. Maximum or Rated Face Velocity: 400 fpm.
7. Initial Resistance: 0.01 inches wg.

8. Minimum Efficiency Reporting Value:

a. MERV Rating: MERV 13, according to ASHRAE 52.2.

H. Vibration Isolation Devices: Isolation with 2” minimum deflection.

I. Electrical Characteristics for Single-Point Connection:

1. Voltage: See plans.
2. Phase: See plans.
3. Hertz: 60 Hz.
4. Full-Load Amperes: See plans.
5. Minimum Circuit Ampacity: See plans.
6. Maximum Overcurrent Protection: See plans.

2.3 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AAON.
2. Allied Commercial.
3. Carrier Global Corporation.
4. Daikin Applied.
5. Trane.
6. YORK; brand of Johnson Controls International plc, Building Solutions North America.

2.4 UNIT CASINGS

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Double-Wall Construction:

1. Outside Casing Wall: Galvanized steel, minimum 18 gauge thick with **manufacturer's standard finish**, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
2. Inside Casing Wall: G90 (Z275)-coated galvanized steel, 0.034 inch thick, perforated 40 percent free area.
3. Floor Plate: G90 galvanized steel, treadplate, minimum 18 gauge thick.
4. Casing Insulation:

a. Materials: Injected polyurethane foam insulation.
b. Insulation Thickness: 1 inch.
c. Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roof of unit.

C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

D. Static-Pressure Classifications:

1. For Unit Sections Upstream of Fans: Minus 2-inch wg.
2. For Unit Sections Downstream and Including Fans: 2-inch wg.

E. Panels and Doors:

1. Panels:

a. Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
b. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
c. Gasket: Neoprene, applied around entire perimeters of panel frames.
d. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.

2. Access Doors:

a. Hinges: A minimum of two ball-bearing hinges or stainless steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
b. Gasket: Neoprene, applied around entire perimeters of panel frames.
c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.

3. Locations and Applications:

a. Fan Section: Doors and inspection and access panels.
b. Access Section: Doors.
c. Coil Section: Inspection and access panels.
d. Damper Section: Inspection and access panels.
e. Filter Section: Inspection and access panels large enough to allow periodic removal and installation of filters.
f. Mixing Section: Doors.

F. Condensate Drain Pans:

1. Location: Each type of cooling coil.
2. Construction:

a. Single-wall, noncorrosive polymer sheet.

3. Drain Connection:

a. Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
b. Minimum Connection Size: NPS 1.

4. Slope: Minimum 0.125-in./ft. slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.
5. Width: Entire width of water producing device.
6. Depth: A minimum of 2 inches deep.
7. Pan-Top Surface Coating for Galvanized-Steel Drain Pans: Asphaltic waterproofing compound.
8. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.5 FANS, DRIVES, AND MOTORS

A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.

B. Supply-Air Fans: Centrifugal, rated according to AMCA 210; galvanized or painted steel; mounted on solid-steel shaft.

1. Shafts: With field-adjustable alignment.

a. Turned, ground, and polished hot-rolled steel with keyway.

2. Shaft Bearings:

a. Heavy-duty, self-aligning, pillow-block type with an L-50 rated life of minimum 100,000 hours according to ABMA 9.

3. Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.

a. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.

4. Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; steel or aluminum hub swaged to backplate and fastened to shaft with setscrews.
5. Mounting: For internal vibration isolation. Factory-mount fans with manufacturer's standard restrained vibration isolation mounting devices having a minimum static deflection of 1 inch.
6. Shaft Lubrication Lines: Extended to a location outside the casing.
7. Flexible Connector: Factory fabricated with a fabric strip minimum 3-1/2 inches wide, attached to two strips of minimum 2-3/4-inch-wide by 0.028-inch-thick, galvanized-steel sheet.

a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.

C. Drives, Direct: Factory-mounted, direct drive.

D. Drives, Belt: Factory-mounted, V-belt drive, with adjustable alignment and belt tensioning, and with 1.5 service factor based on fan motor.

1. Pulleys: Cast iron or cast steel with split, tapered bushing, dynamically balanced at the factory.
2. Belts: Oil resistant, non-sparking and nonstatic; in matched sets for multiple-belt drives.
3. Belt Guards: Comply with requirements specified by OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards"; 0.146-inch-thick, 3/4-inch diamond-mesh wire screen, welded to steel angle frame; prime coated.

E. Condenser-Coil Fan: Variable-speed propeller, mounted on shaft of permanently lubricated ECM motors.

F. Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
3. Enclosure Type: Totally enclosed, fan cooled
4. Motor Pulleys: Adjustable pitch for use with **5**-hp motors and smaller; fixed pitch for use with motors larger than **5** hp. Select pulley size so pitch adjustment is at the middle of adjustment range at fan design conditions.
5. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

2.6 COILS

A. General Requirements for Coils:

1. Comply with AHRI 410.
2. Fabricate coils section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils shall not act as structural component of unit.

B. Supply-Air Refrigerant Coil:

1. Tubes: **Copper**.
2. Fins:
    a. Material: Aluminum.
    b. Fin Spacing: Maximum 12 fins per inch.
3. Fin and Tube Joints: Mechanical bond.
4. Headers: Seamless-copper headers with brazed connections.
5. Frames: Galvanized steel.
6. Coatings: None.
7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.
    a. Working Pressure: Minimum 300 psig.

C. Supply-Air Hydronic Heating Coil:

1. Hot-Water Coils: Continuous circuit.
    a. Piping Connections: Flanged, same end of coil.
    b. Tube Material: Copper.
    c. Fin Type: Plate.
    d. Fin Material: Aluminum.
    e. Fin Thickness: .
    f. Fin and Tube Joint: Mechanical bond.
    g. Headers:
        1) Cast iron with cleaning plugs and drain and air vent tappings extended to exterior of unit.
        2) Seamless copper tube with brazed joints, prime coated.
        3) Fabricated steel, with brazed joints, prime coated.
        4) Provide insulated cover to conceal exposed outside casings of headers.

h. Frames: Channel frame, minimum 0.052-inch-thick galvanized steel.
i. Coil Working-Pressure Ratings: 200 psig, 325 deg F.
j. Coating: None.

D. Hot-Gas Reheat Refrigerant Coil:

1. Tubes: Copper.
2. Fins:

a. Material: Aluminum.
b. Fin Spacing: Maximum 12 fins per inch.

3. Fin and Tube Joints: Mechanical bond.
4. Headers: Seamless-copper headers with brazed connections.
5. Frames: Galvanized steel.
6. Coatings: None.
7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.

a. Working Pressure: Minimum 300 psig.

8. Suction-discharge bypass valve.

2.7 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: See plans.

B. Compressor: Hermetic, variable speed scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

C. Refrigeration Specialties:

1. Refrigerant: R-454B.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.
9. Low-ambient kit high-pressure sensor.
10. Hot-gas reheat solenoid valve modulating with a replaceable magnetic coil.
11. Hot-gas bypass solenoid valve with a replaceable magnetic coil.
12. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

2.8 AIR FILTRATION

A. Particulate air filtration is specified in Section 234100 "Particulate Air Filtration."

B. Panel Filters:

1. Description: Pleated factory-fabricated, self-supported, disposable air filters with holding frames.

2. Filter Unit Class: UL 900.
3. Media: Interlaced glass, synthetic or cotton fibers coated with nonflammable adhesive and antimicrobial coating.
4. Filter-Media Frame: Beverage board with perforated metal retainer, or metal grid, on outlet side.

2.9 DAMPERS

A. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in parallel-blade arrangement with zinc-plated steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 4 cfm/sq. ft. (20 L/s per sq. m) at 1-inch wg (250 Pa) and 8 cfm/sq. ft. (40 L/s per sq. m) at 4-inch wg (1.0 MPa) rated in accordance with AMCA 500D.)

B. Barometric relief dampers.

C. Electronic Damper Operators:

1. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
2. Electronic damper position indicator shall have visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
3. Operator Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    b. Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
    c. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.

4. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
5. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
6. Size dampers for running torque calculated as follows:

    a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.
    b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.
    c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft (49.6 kg-cm/sq. m) of damper.
    d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. (37.2 kg-cm/sq. m) of damper.
    e. Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.
    f. Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.

7. Coupling: V-bolt and V-shaped, toothed cradle.
8. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
9. Fail-Safe Operation: Mechanical, spring-return mechanism with external, manual gear release on nonspring-return actuators.
10. Power Requirements (Two-Position Spring Return): 24 V dc.
11. Power Requirements (Modulating): Maximum 10 VA at 24 V ac or 8 W at 24 V dc.
12. Proportional Signal: 2 to 10 V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
13. Temperature Rating: Minus 22 to plus 122 deg F (Minus 30 to plus 50 deg C).
14. Run Time: 12 seconds open, 5 seconds closed.

2.10 ELECTRICAL POWER CONNECTIONS

A. RTU shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.11 CONTROLS

A. Basic Unit Controls:

1. Control-voltage transformer.
2. Wall-mounted thermostat or sensor with the following features:

    a. Heat-cool-off switch.
    b. Fan on-auto switch.
    c. Fan-speed switch.
    d. Automatic changeover.
    e. Adjustable deadband.
    f. Concealed set point.
    g. Exposed indication.
    h. Degree F Degree C indication.
    i. Unoccupied-period-override push button.
    j. Data entry and access port to input temperature and humidity set points, occupied and unoccupied periods, and output room temperature and humidity, supply-air temperature, operating mode, and status.

3. Unit-Mounted Annunciator Panel for Each Unit:

    a. Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
    b. DDC controller or programmable timer and interface with HVAC instrumentation and control system.
    c. Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.

B. DDC Controller:

1. Controller shall have volatile-memory backup.
2. Safety Control Operation:

    a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.

b. Firestats: Stop fan and close outdoor-air damper if air greater than 130 deg F (54 deg C) enters unit. Provide additional contacts for alarm interface to fire alarm control panel.
c. Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in Section 284621.11 "Addressable Fire-Alarm Systems."
d. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40 deg F (4 deg C).
e. Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.

3. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
4. Unoccupied Period:

a. Heating Setback: Plus 10 deg F (Minus 11 deg C).
b. Cooling Setback: System off.
c. Override Operation: Two hours.

5. Supply Fan Operation:

a. Occupied Periods: Run fan continuously.
b. Unoccupied Periods: Cycle fan to maintain setback temperature.

6. Refrigerant Circuit Operation:

a. Occupied Periods: Cycle or stage compressors, and operate hot-gas bypass to match compressor output to cooling load to maintain room temperature. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.
b. Unoccupied Periods: Compressors off.
c. Switch reversing valve for heating or cooling mode on air-to-air heat pump.

7. Hot-Gas Reheat-Coil Operation:

a. Occupied Periods: Humidistat opens hot-gas valve to provide hot-gas reheat, and cycles compressor.
b. Unoccupied Periods: Reheat not required.

8. Economizer Outdoor-Air Damper Operation:

a. Morning warm up cycles.
b. Occupied Periods: Open to 10 percent fixed minimum intake, and maximum 100 percent of the fan capacity. Controller shall permit air-side economizer operation when outdoor air is less than 60 deg F (15 deg C). Use mixed-air temperature and select between outdoor-air and return-air enthalpy to adjust mixing dampers. Start relief-air fan with end switch on outdoor-air damper. During economizer cycle operation, lock out cooling.
c. Unoccupied Periods: Close outdoor-air damper and open return-air damper.
d. Outdoor-Airflow Monitor: Accuracy maximum plus or minus 5 percent within 15 and 100 percent of total outdoor air. Monitor microprocessor shall adjust for temperature, and output shall range from 2- to 10-V dc.

9. Carbon Dioxide Sensor Operation:

a. Occupied Periods: Reset minimum outdoor-air ratio down to minimum 10 percent to maintain maximum 1000-ppm concentration.
b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.

10. Terminal-Unit Relays:

a. Provide heating- and cooling-mode changeover relays compatible with terminal control system required in Section 233600 "Air Terminal Units" and Section 230923 "Direct Digital Control (DDC) System for HVAC."

C. Interface Requirements for HVAC Instrumentation and Control System:

1. Interface relay for scheduled operation.
2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
3. Provide BACnet compatible interface for central HVAC control workstation for the following:

a. Adjusting set points.
b. Monitoring supply fan start, stop, and operation.
c. Inquiring data to include outdoor-air damper position, supply- and room-air temperature and humidity.
d. Monitoring occupied and unoccupied operations.
e. Monitoring constant and variable motor loads.
f. Monitoring variable-frequency drive operation.
g. Monitoring cooling load.
h. Monitoring economizer cycles.
i. Monitoring air-distribution static pressure and ventilation air volume.

2.12 ROOF CURBS

A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Curb Dimensions: Height of 20”. Adaptable horizontal dimensions as required for existing roof openings.

2.13 ACCESSORIES

A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.

B. Low-ambient kit using variable-speed condenser fans for operation down to 35 deg F (1.7 deg C).

C. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

D. Remote potentiometer to adjust minimum economizer damper position.

E. Return-air bypass damper.

F. Factory- or field-installed demand-controlled ventilation.

G. Safeties:

1. Smoke detector.
2. Condensate overflow switch.
3. Phase-loss reversal protection.
4. High and low pressure control.

H. Concentric diffuser with white louvers and polished aluminum return grilles, insulated diffuser box with mounting flanges, and interior transition.

I. Door switches to disable heating or reset set point when open.

J. Outdoor air intake weather hood with moisture eliminator.

K. Service Lights and Switch: Factory installed in each accessible section with weatherproof cover. Factory wire lights to a single-point field connection.

2.14 MATERIALS

A. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209 (ASTM B209M).

2.15 SOURCE QUALITY CONTROL

A. AHRI Compliance:

1. Comply with AHRI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with AHRI 270 for testing and rating sound performance for RTUs.
3. Comply with AHRI 1060 for testing and rating performance for air-to-air exchanger.

B. AMCA Compliance:

1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
2. Damper leakage tested in accordance with AMCA 500-D.
3. Operating Limits: Classify according to AMCA 99.

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 RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "NRCA Roofing Manual: Membrane Roof Systems." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.

1. Install normal-weight, 3000-psi (20.7-MPa), compressive strength (28-day) concrete mix inside roof curb, 4 inches (100 mm) thick. Concrete, formwork, and reinforcement are specified with concrete.

B. Equipment Mounting:
1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

3.3 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to RTU, allow space for service and maintenance.

C. Connect piping to unit mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using NPS 1, ASTM B88, Type M (ASTM B88M, Type C) copper tubing. Extend to nearest equipment or roof drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

E. Hot-Water Piping: Comply with applicable requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

3.4 DUCT CONNECTIONS

A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
4. Install return-air duct continuously through roof structure.

3.5 ELECTRICAL CONNECTIONS

A. Connect electrical wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs as specified in Section 260553 "Identification for Electrical Systems."
2. Locate nameplate where easily visible.

3.6 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions.

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, coils, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean condenser coil and inspect for construction debris.
10. Remove packing from vibration isolators.

11. Inspect operation of barometric relief dampers.
12. Verify lubrication on fan and motor bearings.
13. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
14. Adjust fan belts to proper alignment and tension.
15. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system.
    b. Do not operate below recommended low-ambient temperature.
    c. Complete startup sheets and attach copy with Contractor's startup report.

16. Inspect and record performance of interlocks and protective devices; verify sequences.
17. Operate unit for an initial period as recommended or required by manufacturer.

18. Calibrate thermostats.
19. Adjust and inspect high-temperature limits.
20. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
21. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F (8 deg C) above return-air temperature:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

22. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
23. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Return-air volume.
    c. Relief-air volume.
    d. Outdoor-air intake volume.

24. Simulate maximum cooling demand and inspect the following:

    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

25. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

    a. High-temperature limit on gas-fired heat exchanger.
    b. Low-temperature safety operation.
    c. Filter high-pressure differential alarm.
    d. Economizer to minimum outdoor-air changeover.
    e. Relief-air fan operation.
    f. Smoke and firestat alarms.

26. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.8 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.9 CLEANING

A. After completing system installation and testing, adjusting, and balancing RTUs and air-distribution systems and after completing startup service, clean RTUs internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. RTU will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes complete VRF HVAC system(s) including, but not limited to the following components to make a complete operating system(s) according to requirements indicated:

1. Indoor, concealed, ceiling and floor mounted units for ducting.
2. Indoor, exposed, floor and wall mounted units.
3. Indoor, recessed, ceiling-mounted units.
4. Indoor, dedicated outdoor air ventilation units.
5. Indoor, energy recovery ventilator.
6. Outdoor, air-source heat recovery units.
7. Heat recovery control units.
8. System controls.
9. System refrigerant and oil.
10. System condensate drain piping.
11. System refrigerant piping.
12. Metal hangers and supports.
13. Metal framing systems.
14. Fastener systems.
15. Miscellaneous support materials.
16. Piping and tubing insulation.
17. System control cable and raceways.
18. Materials
19. Source quality controls
20. Vibration isolation.

1.3 DEFINITIONS

A. Air-Conditioning System Operation: System capable of operation with all zones in cooling only.

B. Heat-Pump System Operation: System capable of operation with all zones in either heating or cooling, but not with simultaneous heating and cooling zones that transfer heat between zones.

C. Heat Recovery System Operation: System capable of operation with simultaneous heating and cooling zones that transfer heat between zones.

D. HRCU: Heat Recovery Control Unit. HRCUs are used in heat recovery VRF HVAC systems to manage and control refrigerant between indoor units to provide simultaneous heating and cooling zones. "Heat Recovery Control Unit" is the term used by ASHRAE for what different manufacturers term as branch circuit controller, branch selector box, changeover box, flow selector unit, mode change unit, and other such terms.

E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

F. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

G. Three-Pipe System Design: One high pressure refrigerant vapor line, one low pressure refrigerant vapor line, and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One liquid line and refrigerant vapor line connect HRCUs to associated indoor units.

H. Two-Pipe System Design: One refrigerant vapor line and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One refrigerant liquid line and refrigerant vapor line connect HRCUs to associated indoor units. HRCUs used in two pipe systems act as an intermediate heat exchanger and include diverting valves and gas/liquid separators to move high and low pressure refrigerant between indoor units.

I. VRF: Variable refrigerant flow.

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 for indoor and outdoor units and for HRCUs.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Include operating performance at design conditions and at extreme maximum and minimum outdoor ambient conditions.
4. Include description of system controllers, dimensions, features, control interfaces and connections, power requirements, and connections.
5. Include system operating sequence of operation in narrative form for each unique indoor- and outdoor-unit and HRCU control.
6. Include description of control software features.
7. Include total refrigerant required and a comprehensive breakdown of refrigerant required by each system installed.
8. Include refrigerant type and data sheets showing compliance with requirements indicated.
9. For system design software.
10. Indicate location and type of service access.

B. Shop Drawings: For VRF HVAC systems.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
4. Include diagrams and details of refrigerant piping and tubing showing installation requirements for manufacturer-furnished divided flow fittings.
5. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For fully and partially exposed indoor units with factory finishes viewable by occupants.

1. Include a Sample for each unique finish with unit identification, detailed description of application, and cross-referenced floor plans showing locations.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, sections, and details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural floors, roofs and associated members to which equipment, piping, ductwork, cables, and conduit will be attached.
3. Size and location of initial access modules for acoustical tile.
4. Wall-mounted controllers located in finished space showing relationship to light switches, fire-alarm devices, and other installed devices.
5. Size and location of access doors and panels installed behind walls and inaccessible ceilings for products installed behind walls and requiring access.
6. Items penetrating finished ceiling including the following:

a. Luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Service access panels.
f. Fire alarm devices

B. Qualification Data:

1. For Installer: Certificate from VRF HVAC system manufacturer certifying that Installer has successfully completed prerequisite training administered by manufacturer for proper installation of systems, including but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.

a. Retain copies of Installer certificates on-site and make available on request.

2. For VRF HVAC system manufacturer.
3. For VRF HVAC system provider.

C. Product Test Reports: Where tests are required, for each product, for tests performed by the manufacturer and witnessed by a qualified testing agency.

D. Source quality-control reports.

E. Field quality-control reports.

F. Sample Warranties: For manufacturer's warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VRF HVAC systems to include in emergency, operation, and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On CD or DVD, USB media, or approved cloud storage platform, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

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. Filters:

    a. One set(s) for each unit with replaceable filters.
    b. One set(s) for each unit type and unique size of washable filters.

2. Indoor Units: One for each unique size and type installed.
3. Controllers for Indoor Units: One for each unique controller type installed.
4. Insert maintenance material requirements.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Nationally recognized manufacturer of VRF HVAC systems and products.
2. Shipped VRF HVAC systems with similar requirements to those indicated for a continuous period of five years within time of bid.
3. VRF HVAC systems and products that have been successfully tested and in use on at least five completed projects.
4. Having complete published catalog literature, installation, and operation and maintenance manuals for all products intended for use.
5. Having full-time in-house employees for the following:

    a. Product research and development.
    b. Product and application engineering.
    c. Product manufacturing, testing, and quality control.
    d. Technical support for system installation training, startup, commissioning, and troubleshooting of installations.
    e. Owner training.

B. Factory-Authorized Service Representative Qualifications:

1. Authorized representative of, and trained by, VRF HVAC system manufacturer.
2. Demonstrated past experience with products being installed for period within three consecutive years before time of bid.
3. Demonstrated past experience on five projects of similar complexity, scope, and value.

a. Each person assigned to the Project shall have demonstrated past experience.

4. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
5. Service and maintenance staff assigned to support Project during warranty period.
6. VRF HVAC system manufacturer's backing to take over execution of Work if necessary to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer's corporate officer, if requested.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by VRF HVAC system manufacturer.

1. Each employee shall be certified by the manufacturer for proper installation of systems, including, but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
2. Installer certification shall be valid and current for duration of Project.
3. Retain copies of Installer certificates on-site and make available on request.
4. Each person assigned to the Project shall have demonstrated past experience.

a. Demonstrated past experience with products being installed for period within three consecutive years before time of bid.
b. Demonstrated past experience on five projects of similar complexity, scope, and value.

D. Mockups: Build mockups to set quality standards for materials and execution.

1. Build mockups to show a finished installation for each of the following applications:

a. For each different indoor unit type with exposed surfaces viewable by occupants.
b. One typical ceiling cassette unit

2. Mockups need to be operational to test controls and sound.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. ISO Compliance: System equipment and components furnished by VRF HVAC system manufacturer shall be manufactured in an ISO 9001 and ISO 14001 facility.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in a clean and dry place.

B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.

C. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.

D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.

1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.
2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remover coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.

E. Replace installed products damaged during construction.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace equipment and components that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
d. .

2. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts, Including Controls: Five year(s) from date of Substantial Completion.
c. For Labor: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: the basis of design shall be LG Electronics. Other manufactures that may be acceptable, subject to compliance with requirements of the contract documents, and review and approval by the engineer.

1. Carrier Corporation /Toshiba.
2. Daikin AC (Americas), Inc.
3. Samsung HVAC.

B. Source Limitations: Obtain products from single source from single manufacturer including, but not limited to, the following:

1. Indoor and outdoor units, including accessories.
2. Controls and software.
3. HRCUs.
4. Refrigerant isolation valves.
5. Specialty refrigerant pipe fittings.

2.2 SYSTEM DESCRIPTION

A. Direct-expansion (DX) VRF HVAC system(s) with variable capacity in response to varying cooling and heating loads. System shall consist of multiple indoor units, HRCUs, outdoor unit(s), piping, controls, and electrical power to make complete operating system(s) complying with requirements indicated.

1. Three-pipe system design.
2. System(s) operation, heat recovery as indicated on Drawings.
3. Each system with one refrigerant circuit shared by all indoor units connected to system.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. AHRI Compliance: System and equipment performance certified according to AHRI 1230 and products listed in AHRI directory.

D. ASHRAE Compliance:

1. ASHRAE 15: For safety code for mechanical refrigeration.
2. ASHRAE 62.1: For indoor air quality.
3. ASHRAE 135: For control network protocol with remote communication.
4. ASHRAE/IES 90.1 Compliance: For system and component energy efficiency.

E. UL Compliance: Comply with UL 1995.

2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer or specialist, as defined in Section 014000 "Quality Requirements," to design complete and operational VRF HVAC system(s) complying with requirements indicated.

1. Provide system refrigerant calculations.

    a. Refrigerant concentration limits shall be within allowable limits of ASHRAE 15 and governing codes.
    b. Indicate compliance with manufacturer's maximum vertical and horizontal travel distances. Prepare a comparison table for each system showing calculated distances compared to manufacturer's maximum allowed distances.

2. Include a mechanical ventilation system and gas detection system as required to comply with ASHRAE 15 and governing codes.
3. System Refrigerant Piping and Tubing:

    a. Arrangement: Arrange piping to interconnect indoor units, HRCUs, and outdoor unit(s) in compliance with manufacturer requirements and requirements indicated.
    b. Routing: Conceal piping above ceilings and behind walls to maximum extent possible.
    c. Sizing: Size piping system, using a software program acceptable to manufacturer, to provide performance requirements indicated. Consider requirements to accommodate future change requirements.

4. System Controls:

a. Network arrangement.
b. Network interface with other building systems.
c. Product selection.
d. Sizing.

B. Service Access:

1. Provide and document service access requirements.
2. Locate equipment, system isolation valves, and other system components that require service and inspection in easily accessible locations. Avoid locations that are difficult to access if possible.
3. Where serviceable components are installed behind walls and above inaccessible ceilings, provide finished assembly with access doors or panels to gain access. Properly size the openings to allow for service, removal, and replacement.
4. If less than full and unrestricted access is provided, locate components within an 18-inch reach of the finished assembly.
5. Where ladder access is required to service elevated components, provide an installation that provides for sufficient access within ladder manufacturer's written instructions for use.
6. Comply with OSHA regulations.

C. System Design and Installation Requirements:

1. Design and install systems indicated according to manufacturer's recommendations and written instructions.
2. Where manufacturer's requirements differ from requirements indicated, contact Architect for direction. The most stringent requirements should apply unless otherwise directed in writing by Architect.

D. Isolation of Equipment: Provide isolation valves to isolate each HRCU, indoor unit and outdoor unit for service, removal, and replacement without interrupting system operation.

E. System Capacity Ratio: The sum of connected capacity of all indoor units shall be within the following range of outdoor-unit rated capacity:

1. Not less than 60 percent.
2. Not more than 130 percent.
3. Range acceptable to manufacturer.

F. System Turndown: Stable operation down to 20 percent of outdoor-unit capacity.

G. System Auto Refrigerant Charge: Each system shall have an automatic refrigerant charge function to ensure the proper amount of refrigerant is installed in system.

H. Outdoor Conditions:

1. Suitable for outdoor ambient conditions encountered.
   a. Design equipment and supports to withstand snow and ice loads of governing code and ASCE/SEI 7.
   b. Provide corrosion-resistant coating for components and supports where located in coastal or industrial climates that are known to be harmful to materials and finishes.

2. Maximum System Operating Outdoor Temperature: See Drawings.

I. Thermal Movements: Allow for controlled thermal movements from ambient, surface, and system temperature changes.

J. Capacities and Characteristics: As indicated on Drawings.

2.4 INDOOR, CONCEALED, HORIZONTAL OR VERTICAL UNITS FOR DUCTING

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.

B. Cabinet:

1. Material: 22-gauge Pre-Coated Metal Galvanized or painted steel.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
4. Mounting: Manufacturer-designed provisions for field installation.
5. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
6. The inside surface of fan assembly door access panel shall be treated with 1/2 inch polystyrene fiber insulation, encapsulated on both sides.
7. The external insulation shall be plenum rated and conform to ASTM Standard D-1418.

C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Unit shall have minimum two to three row coil, 18 fins per inch.
5. Unit shall have a factory supplied condensate drain pan below the coil constructed of HIPS (high impact polystyrene resin).
6. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
7. Unit Internal Tubing: Copper tubing with brazed joints.
8. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
9. Field Piping Connections: Manufacturer's standard.
10. Factory Charge: Dehydrated air or nitrogen.
11. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
3. Field Piping Connection: Non-ferrous material with threaded NPT.
4. Unit shall have a factory supplied condensate drain pan below the coil constructed of HIPS (high impact polystyrene resin).
5. The unit shall have a secondary drain port plug for overflow.

E. Fan and Motor Assembly:

1. Fan(s):

a. Direct-drive arrangement.
b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
c. Fabricated from non-ferrous components or ferrous components with corrosion-resistant finish.
d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.
6. The fan speed shall be controlled using a microprocessor based direct digitally controlled algorithm that provides a minimum of three pre-programed fan speeds. Each setting is also adjustable by field setting to compensate for a limited amount of additional resistance to airflow by adjusting the RPM of the fan motor.
7. In cooling mode, the indoor fan shall have the following settings: Low, Med, High, and Auto.
8. In heating mode, the indoor fan shall have the following settings: Low, Med, High, and Auto.
9. Each of the settings can be field adjusted from the factory setting (RPM/ESP).
10. Unit shall be designed for high-speed air volume against an external static pressure of up to 1.0” water gauge model dependent.

F. Filter Assembly:

1. Access: Bottom, side, or rear to accommodate field installation without removing ductwork and to accommodate filter replacement without need for tools.
2. The filter access shall be from the front of the unit without removing coil or fan area access panel.
3. The filter access door shall be fitted with thumb screws that can be removed without the use of any tool.
4. Efficiency: ASHRAE 52.2, MERV 11.
5. Media:

a. Replaceable: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.

G. Unit Accessories:

1. Outdoor Air Ventilation Kit: Connection, motorized damper, and control sized to allow sequence of operation indicated on Drawings.
2. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.
3. .

H. Unit Controls:

1. Enclosure: Metal, suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Microprocessor Control
   a. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system with or without the use of a

wall mounted controller. The unit shall have a factory mounted return air thermistor for use as a space temperature control device. All operating parameters except scheduling shall be stored in non-volatile memory resident on the microprocessor. The microprocessor shall provide the following functions, self-diagnostics, auto re-start after a power failure and a test run mode.

b. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, two core, stranded, twisted, and shielded communication cable.
c. The unit controls shall operate the indoor unit using one of the five operating modes:
    1) Auto changeover (Heat Recovery System only)
    2) Heating
    3) Cooling
    4) Dry
    5) Fan only
d. The unit shall be able to operate in either cooling or heating mode for testing and/or commissioning.
e. The unit shall be able to operate with the fan turned off during system cooling thermal off.
f. The unit shall be able to operate with a continuous fan setting.
g. The unit shall have adjustable, multi-step cooling and heating mode thermal on/off temperature range settings.
h. The system shall include a product check function to access and display indoor unit type and capacity from a wired programmable zone controller.

4. Factory-Installed Sensors:

    a. Unit inlet air temperature.
    b. Coil entering refrigerant temperature.
    c. Coil leaving refrigerant temperature.

5. Field-Customizable I/O Capability:

    a. Analog Inputs: Four for use in customizable control strategies.
    b. Digital Inputs: Four for use in customizable control strategies.
    c. Digital Outputs: Four for use in customizable control strategies.

6. Features and Functions:

    a. Self-diagnostics.
    b. Time delay.
    c. Auto-restart.
    d. External static pressure control.
    e. Auto operation mode.
    f. Manual operation mode.
    g. Filter service notification.
    h. Power consumption display.
    i. Drain assembly high water level safety shutdown and notification.
    j. Run test switch.

7. Communication: Network communication with other indoor and outdoor units.
8. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
9. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

10. Unit shall use controls provided by the manufacturer to perform all functions necessary to operate the system effectively and efficiently and communicate with the outdoor unit over an RS-485 daisy chain.

I. Unit Electrical:

1. Enclosure: Metal, suitable for indoor locations.
2. Field Connection: Single point connection to power unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in raceways.

2.5 INDOOR, EXPOSED, FLOOR and WALL MOUNTED UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.
1. Unit shall be factory assembled, wired, piped and run tested.
2. Unit shall be designed to be installed for indoor application.
3. The unit shall be designed to be free standing on the floor against a wall with factory supplied enclosure or may be located within a field provided architectural enclosure.
4. The back plate of the unit shall have two side mounting flanges with bolt holes to allow a secure attachment of the unit to a vertical surface at or above the floor
5. The discharge shall be vertical from the top of the unit.
6. The return air shall be from the bottom front through a toe slot at floor level.
7. The discharge air opening shall be covered with an architectural grille for units supplied with factory enclosure.
8. Floor standing indoor units without enclosure shall be installed under a field supplied and installed enclosure that does not introduce any significant external static pressure.

B. Cabinet:

1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
5. The cold surface shall be covered with a coated polystyrene insulating material.
6. The unit shall have a flip open controller access door that shall cover the control mounting bays located on both ends of the top panel.
7. The unit shall have a polymeric resin coated metal safety grille provided behind the removable filters.
8. Unit shall have one supply air outlet and one return air inlet at the toe slot at the floor level.

C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.

3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.
10. Unit shall have minimum of a two-row coil, 19 fins per inch.
11. The coil shall be factory pressure tested at a minimum of 550 psig.
12. All refrigerant piping from outdoor unit to indoor unit shall be field insulated. Each pipe should be insulated separately. Thickness and heat transfer characteristics shall be determined by the design engineer and shall meet all code requirements.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Gravity.

    a. If a floor drain is not available at unit, provide unit with field-installed condensate pump accessory.

3. Field Piping Connection: Non-ferrous material with threaded NPT.
4. Unit shall have a factory supplied condensate drain pan below the coil constructed of EPS (expandable polystyrene resin).

E. Fan and Motor Assembly:

1. Fan(s):

    a. Direct-drive arrangement.
    b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
    c. Materials: Non-ferrous components or ferrous components with corrosion-resistant finish.
    d. Statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.
6. The fan speed shall be controlled using a microprocessor, based direct digitally controlled algorithm that provides a minimum of three pre-programed fan speeds in the heating mode and fan only mode and four speeds in the cooling mode. The fan speed algorithm provides a field selectable fixed speed.
7. In cooling mode, the indoor fan shall have the following settings: Low, Med, High, and Auto.
8. In heating mode, the indoor fan shall have the following settings: Low, Med, High, and Auto.
9. Unit shall be designed for high-speed air volume against an external static pressure of up to 0.08” water gauge (uncased).

F. Filter Assembly:

1. Access: Front, to accommodate filter replacement without the need for tools.
2. Efficiency: MERV 11
3. The unit shall have an access to the filter media through toe slot located on the front of unit without the need to remove any panels.
4. The filters shall be accessible without removing the unit panel.

G. Grille Assembly: Manufacturer's standard discharge grille with field-adjustable air pattern mounted in top of unit cabinet.

H. Unit Accessories:

1. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.
2. Condensate Pump: Integral reservoir and control with electrical power connection through unit power.

I. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Microprocessor Control
   a. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system with or without the use of a wall mounted controller. The unit shall have a factory mounted return air thermistor for use as a space temperature control device. All operating parameters except scheduling shall be stored in non-volatile memory resident on the microprocessor. The microprocessor shall provide the following functions, self-diagnostics, auto re-start after a power failure and a test run mode.
   b. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, two core, stranded, twisted, and shielded communication cable.
   c. The unit controls shall operate the indoor unit using one of the five operating modes:
   d. Auto changeover (Heat Recovery System only)
   e. Heating
   f. Cooling
   g. Dry
   h. Fan only
   i. The unit shall be able to operate in either cooling or heating mode for testing and/or commissioning.
   j. The unit shall be able to operate with the fan turned off during system cooling thermal off.
   k. The unit shall be able to operate with a continuous fan setting.
   l. The unit shall have adjustable, multi-step cooling and heating mode thermal on/off temperature range settings.
   m. The system shall include a product check function to access and display indoor unit type and capacity from a wired programmable zone controller.

4. Factory-Installed Sensors:

   a. Unit inlet air temperature.
   b. Coil entering refrigerant temperature.
   c. Coil leaving refrigerant temperature.

5. Field-Customizable I/O Capability:

a. Analog Inputs: Four for use in customizable control strategies.
b. Digital Inputs: Insert number for use in customizable control strategies.
c. Digital Outputs: Four for use in customizable control strategies.

6. Features and Functions:

a. Self-diagnostics.
b. Time delay.
c. Auto-restart.
d. External static pressure control.
e. Auto operation mode.
f. Manual operation mode.
g. Filter service notification
h. Power consumption display.
i. Drain assembly high water level safety shutdown and notification.
j. Run test switch.

7. Communication: Network communication with other indoor units and outdoor unit(s).
8. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
9. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

J. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in raceways.

2.6 INDOOR, RECESSED, CEILING-MOUNTED UNITS (CEILING CASSETTES)

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.
1. Unit shall be designed to mount recessed in the ceiling and has a surface mounted grille on the bottom of the unit.
2. The unit shall be available in both nominal 2’ x 2’ and 3’ x 3’ chassis.

B. Cabinet:

1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
5. The unit panel shall be provided with an off-white or black Acrylonitrile Butadiene Styrene (ABS) polymeric resin grille.

6. The grille shall have a tapered trim edge, and a hinged, spring clip (screw-less) return air filter-grille door.
7. Unit shall be provided with metal ears designed to support the unit weight on four corners.
8. Ears shall have pre-punched holes designed to accept field supplied all thread rod hangers.
9. Unit shall be supplied with snap off access panels to facilitate leveling of unit without removing the grille.
10. Unit shall have four supply air outlets and one return air inlet.
11. The supply air outlet shall be through four directional slot diffusers each equipped with independent oscillating motorized guide vanes designed to change the airflow direction.
12. The grille shall have a discharge range of motion of 40° in an up/down direction with capabilities of locking the vanes.
13. The unit shall have a guide vane algorithm designed to sequentially change the predominant discharge airflow direction in counterclockwise pattern.
14. Guide vanes shall provide airflow in all directions.

C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Unit shall have a minimum one or two row coil, 18-19 fins per inch.
5.
6. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
7. Internal Tubing: Copper tubing with brazed joints.
8. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
9. Field Piping Connections: Manufacturer's standard.
10. Factory Charge: Dehydrated air or nitrogen.
11. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
3. Field Piping Connection: Non-ferrous material with threaded NPT.
4. Unit shall have a factory supplied condensate drain pan below the coil constructed of EPS (expandable polystyrene resin).
5.

E. Fan and Motor Assembly:

1. Fan(s):

    a. Direct-drive arrangement.
    b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
    c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
    d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.

4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.
6. The fan speed shall be controlled using a microprocessor, based direct digitally controlled algorithm that provides a minimum of four pre-programed fan speeds in the heating mode and fan only mode and five speeds in the cooling mode. The fan speed algorithm provides a field selectable fixed speed.
7. A field setting shall be provided to vary air throw pattern to compensate for high ceiling installations.
8. In cooling mode, the indoor fan shall have the following settings: Low, Med, High, Super high, Power Cool, and Auto.
9. In heating mode, the indoor fan shall have the following settings: Low, Med, High, Super high and Auto.
10. Unit shall have factory installed motorized louver to provide flow of air in up and down direction for uniform airflow.

F. Filter Assembly:

1. Access: Bottom, to accommodate filter replacement without the need for tools.
2. Efficiency: ASHRAE 52.2, MERV 10.
3. Media:

    a. Replaceable: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.
4. The filter access shall be from the bottom of the unit without the need for tools.
5. The nominal 3’x3’ cabinet unit shall have provision for an optional auto-elevating grille kit designed to provide motorized ascent/descent of the return air grille/pre filter assembly.
6. The ascent/descent of the return air grille shall be up to a distance of 14-3/4 feet allowing access to remove and clean the filter.
7. The auto-elevating grille shall have a control algorithm to accept up, down and stop control commands from the controller.

G. Discharge-Air Grille Assembly: Mounted in bottom of unit cabinet.

1. Discharge Pattern: One-, two-, three-, or four-way throw as indicated on Drawings.

    a. Discharge Pattern Adjustment: Field-adjustable limits for up and down range of motion.
    b. Discharge Pattern Closure: Ability to close individual discharges of units with multiple patterns.

2. Motorized Vanes: Modulating up and down flow pattern for uniform room air distribution.
3. Additional Branch Supply Duct Connection: Sheet metal knockout for optional connection to one additional supply branch duct.

H. Return-Air Grille Assembly: Manufacturer's standard grille mounted in bottom of unit cabinet.

I. Outdoor Air Ventilation Connection: Sheet metal knockout for optional connection to outdoor air ventilation duct.

J. Unit Accessories:

1. Outdoor Air Ventilation Kit: Connection, motorized damper, and control to satisfy unit control sequence of operation indicated on Drawings.
2. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.

K. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Microprocessor Control
   a. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system.
   b. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, two core, stranded, twisted and shielded communication cable.
   c. The unit controls shall operate the indoor unit using one of the five operating modes:
   d. Auto changeover (Heat Recovery System only)
   e. Heating
   f. Cooling
   g. Dry
   h. Fan only
   i. The unit shall be able to operate in either cooling or heating mode for testing and/or commissioning.
   j. The unit shall be able to operate with the fan turned off during system cooling thermal off.
   k. The unit shall have adjustable, multi-step cooling and heating mode thermal on/off temperature range settings.
   l. The system shall include a product check function to access and display indoor unit type and capacity from a wired programmable thermostat controller.
   m. Unit shall have a field settable method to choose auto fan speed change operation based on mode of operation, on/off fan operation based on mode of operation, or continuous minimum set fan speed operation.
4. Factory-Installed Sensors: Unit inlet air temperature Coil entering refrigerant temperature Coil leaving refrigerant temperature.
5. Field-Customizable I/O Capability:

   a. Analog Inputs: Four for use in customizable control strategies.
   b. Digital Inputs: Four for use in customizable control strategies.
   c. Digital Outputs: Four for use in customizable control strategies.

6. Features and Functions: Self-diagnostics, time delay, auto-restart, external static pressure control, auto operation mode , manual operation mode , filter service notification , power consumption display , drain assembly high water level safety shutdown and notification , run test switch.
7. Communication: Network communication with other indoor units and outdoor unit(s).
8. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
9. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

L. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.

3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in raceways to comply with NFPA 70.

2.7 INDOOR, DEDICATED OUTDOOR AIR VENTILATION UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.

1. Specially designed for up to 100 percent outdoor air entering unit.
2. All OAU indoor unit coils shall pressure tested with dry nitrogen to a minimum of 500 psi in the field, coils and indoor units containing coils not rated for 500 psi or more shall not be permitted.

B. Cabinet:

1. Material: Galvanized or painted steel.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. The cold surfaces of the unit shall be covered externally with sheet insulation made of Ethylene Propylene Diene Monomer (M-Class) (EPDM)
4. The external insulation shall be plenum rated and conform to ASTM Standard D-1418.
5. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
6. Mounting: Manufacturer-designed provisions for field installation.
7. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.
10. All refrigerant piping from outdoor unit to indoor unit shall be field insulated. Each pipe should be insulated separately. Thickness and heat transfer characteristics shall be determined by the design engineer and shall meet all code requirements.

D. DX Coil Assembly for Reheat Applications: Provide units with a reheat coil where indicated on Drawings.

1. Coil Casing: Aluminum, galvanized, or stainless steel.

2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Unit shall have a minimum two to three row coil, 19-21 fins per inch.
4. Coil Tubes: Copper, of diameter and thickness required by performance.
5. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
6. Unit Internal Tubing: Copper tubing with brazed joints.
7. Unit Internal Tubing Insulation: Manufacturer's standard insulation.
8. Field Piping Connections: Manufacturer's standard.
9. Factory Charge: Dehydrated air or nitrogen.
10. Testing: Factory pressure tested and verified to be without leaks.
11. Unit shall have a factory assembled, piped and wired electronic expansion valve (EEV) for refrigerant control.
12. The coil shall be factory pressure tested at a minimum of 550 psig.

E. Drain Assembly:
1. Pan: Non-ferrous material, with bottom sloped to low point drain connection. Unit shall have a factory supplied condensate drain pan below the coil constructed of HIPS (high impact polystyrene resin).
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet capable of providing minimum 27.5 inch lift from bottom surface of the unit. The unit drain pan is supplied with a secondary drain port/plug allowing the pan to be gravity drained and serviced.
3.
4. Field Piping Connection: Non-ferrous material with threaded NPT.

F. Fan and Motor Assembly:

1. Fan(s):

    a. Direct-drive arrangement.
    b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
    c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
    d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. The fan speed shall be controlled using microprocessor based direct digitally controlled algorithm that provides a minimum of three pre-programed fan speeds, each setting is also adjustable by field setting to compensate for a limited amount of additional resistance to airflow by adjusting the RPM of the fan motor.
6. Vibration Control: Integral isolation to dampen vibration transmission.

G. Filter Assembly:

1. Access: Bottom, side, or rear to accommodate field installation without removing ductwork and to accommodate filter replacement without need for tools.
2. Efficiency: ASHRAE 52.2, MERV 13.
3. Replaceable Media: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.
4. The filter access shall be from the rear of the unit.
5.

H. Unit Accessories:

1. Motorized Inlet Damper Kit: Low-leakage damper with spring return electric actuator to fail closed on loss of power. Damper controlled by unit to open when unit is operating and close when unit off.

I. Unit Controls:

1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
2. Microprocessor Control:
   a. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system with or without the use of a wall mounted controller. The unit shall have a factory mounted entering air and discharge air thermistor for use as discharge air control. All operating parameters except scheduling shall be stored in non-volatile memory resident on the microprocessor. The microprocessor shall provide the following functions, self-diagnostics, auto re-start after a power failure and a test run mode.
   b. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, two core, stranded, twisted, and shielded communication cable.
   c. The unit controls shall operate the indoor unit using one of the four operating modes:
   d. Auto
   e. Heating
   f. Cooling
   g. Fan only
   h. The unit shall be able to operate in either cooling or heating mode for testing and/or commissioning.
   i. The unit shall be able to shut off the fan when entering air temperature falls below 23F.
   j. The unit shall operate with a continuous fan setting.
3. Factory-Installed Controller: Configurable digital control.
4. Factory-Installed Sensors: Coil entering refrigerant temperature Coil leaving refrigerant temperature Unit entering-air temperature Unit leaving-air temperature Unit entering-air relative humidity Unit leaving-air relative humidity.
5. Field-Customizable I/O Capability:

   a. Analog Inputs: Four for use in customizable control strategies.
   b. Digital Inputs: Four for use in customizable control strategies.
   c. Digital Outputs: Four for use in customizable control strategies.

6. Features and Functions: Self-diagnostics, time delay, auto-restart, external static pressure control, auto operation mode, manual operation mode , filter service notification , power consumption display , drain assembly high water level safety shutdown and notification , run test switch.
7. Communication: Network communication with other indoor units and outdoor unit(s).
8. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
9. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

J. Unit Electrical:

1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.

3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in raceways to comply with NFPA 70.

2.8 INDOOR, ENERGY RECOVERY UNIT (BRANCH SELECTOR BOX)

A. Description: Factory-assembled and -tested complete unit with components, wiring, and controls required for mating to ductwork, power, and controls field connections.

B. Cabinet:

1. Material: Galvanized steel.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1.
3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
4. Mounting: Manufacturer-designed provisions for field installation.
5. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
6. Unit shall be capable of following operating between 14°F and 113°F ambient temperature.
7. The ERV unit shall have
   a. interlock capability to indoor unit
   b. auto restart function
8. Unit shall have an internally mounted control circuit board to communicate with other indoor units and to the outdoor unit.
9.

C. Damper Assemblies:

1. Outdoor Air Intake and Exhaust Air Discharge:

   a. Low-leakage damper with spring return electric actuator to fail closed on loss of power.
   b. Damper controlled by unit to open when unit is operating and close when unit off.

2. Energy Recovery Heat-Exchanger Bypass:

   a. Low leakage damper with electric actuator with integral controls to bypass outdoor air around the energy recovery heat exchanger during times of favorable weather, and there is no energy-saving benefit to circulate air across the energy recovery heat exchanger.

D. Fan and Motor Assemblies: Separate fan and motor assemblies for supply and exhaust airstreams with control for equal airflow.

1. Fan(s):

   a. Direct-drive arrangement.
   b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.

c. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. The fan speed shall be controlled using a microprocessor based direct digitally controlled algorithm.
6. Vibration Control: Integral isolation to dampen vibration transmission.

E. Filter Assemblies: Separate filter assemblies for outdoor air and exhaust airstreams entering energy recovery heat exchanger.

1. Access: To accommodate filter replacement without the need for tools.
2. Efficiency: ASHRAE 52.2, MERV 10.
3. Replaceable Media: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.
4. The filter access shall be from the bottom of the unit.

F. Energy Recovery Heat Exchanger:

1. Total (sensible and latent) energy exchange between outdoor air and exhaust airstreams with performance indicated on Drawings.
2. Fixed element with no moving parts.
3. AHRI 1060 certified and bearing the AHRI labe1.

G. Cross Flow Air-to-Air heat exchanger
1. The heat exchanger shall be constructed of non-flammable, specially processed paper to allow transfer of heat and humidity.
2. The heat exchanger shall recover energy from indoor air as the air is exhausted outdoors.
3. The recovered energy shall be transferred to the in-coming outdoor air without mixing airstreams.
4. Unit shall have an access panel with a retainer on one side and a hinge on the other to remove air to air cross flow heat exchanger.
5. The air-to-air cross flow heat exchanger shall be able to slide between guides provided on either side inside the unit.
6. The air-to-air cross flow heat exchanger shall be assembled with no moving parts.
7. The supply air passage and exhaust air passage shall be arranged to prevent mixing of airstreams.

H. Unit Accessories:

1. Electric Duct Preheater:

a. Heater operation interlocked with energy recovery ventilator unit.
b. Heater with integral controls to control outdoor air temperature entering energy recovery ventilator unit to a temperature set-point determined by energy recovery ventilator unit manufacturer.
c. Listed and labeled.

I. Unit Controls:

1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
2. Microprocessor Control

a. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system.
b. The unit shall be capable of independent operation with a wall controller or interlocked to Multi V system.
c. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, 2 core, stranded and shielded communication cable.
d. The Microprocessor control shall provide following functions:
e. Auto restart following power restoration.
f. External Static Pressure (ESP) control of fans
g. ERV mode allowing air to pass through air-to-air heat exchanger.

3. Factory-Installed Controller: Configurable digital control.
4. Factory-Installed Sensors:

a. Unit entering outdoor air temperature.
b. Unit leaving supply air temperature.
c. Unit entering exhaust air temperature.
d. Unit leaving exhaust air temperature.
e. Unit entering outdoor air relative humidity.
f. Unit leaving supply air relative humidity.
g. Unit entering exhaust air relative humidity.
h. Unit leaving exhaust air relative humidity.

5. Field-Customizable I/O Capability:

a. Analog Inputs: Four for use in customizable control strategies.
b. Digital Inputs: Four for use in customizable control strategies.
c. Digital Outputs: Four for use in customizable control strategies.

6. Features and Functions: Self-diagnostics, time delay, auto-restart, external static pressure control, local auto operation mode , auto operation through remote signal , manual operation mode , filter service notification , power consumption display , run test switch
7. Communication: Network communication with other indoor units and outdoor unit(s).
8. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
9. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

J. Unit Electrical:

1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in raceways to comply with NFPA 70.

2.9 OUTDOOR, AIR-SOURCE HEAT RECOVERY (CONDENSING) UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

1. Specially designed for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple unit modules that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.
3. All units installed shall be from the same product development generation.
4. Heat recovery system shall require three pipes between the outdoor unit and the heat recovery unit and two pipes between the heat recovery unit and each indoor unit to support simultaneous heating and cooling. Between the outdoor unit and heat recovery unit, one pipe shall support bidirectional flow single state liquid refrigerant. The second pipe shall deliver flow of low pressure, low temperature refrigerant gas from the heat recovery unit to outdoor unit. The third pipe shall deliver single state, super-heated, refrigerant hot gas during simultaneous and 100% heating operations from the outdoor unit to heat recovery unit. Heat Recovery systems using two pipes that deliver mixed state (hot gas and liquid) with separation occurring in heat recovery unit shall not be accepted.
5. Heat pump and Heat recovery outdoor units shall be designed to communicate directly with all VRF indoor units manufactured by the same supplier over a field supplied stranded, twisted and shielded pair wire. Systems requiring intermediary protocol translators, signal boosters, integration with a third-party building management systems (BMS) or any other device required for communication possible shall not be accepted.

B. Operating Conditions
   a. The VRF systems shall be capable of providing continuous compressor operation over the required ambient operating range. Submittal or technical performance data that indicates the required operating ambient range includes data points that do not guarantee continuous compressor operation, noted or footnoted as reference data, shall not be accepted. The required ambient operating range is defined as follows:
   b. Cooling:
      1) Heat Pump & Heat recovery System: With optional low ambient kit from -9.9°F DB to 122°F DB
   c. Heating;
      1) Heat Recovery: -13˚F WB to 61°F WB
   d. Heat Recovery Synchronous (Simultaneous heating and cooling)
      1) Cooling based: 14°F DB to 81°F
      2) Heating-based: 14°F WB to 61°F WB

C. General Features
1. The unit shall be shipped from the factory fully assembled including internal refrigerant piping, inverter driven compressor, controls, contacts, relay(s), fan(s), power and communication wiring.
2. All outdoor units, regardless of the Heat Pump or Heat Recovery models, shall be the same generation and provide with most up to date firmware version at the time of delivery. Manufacturers commissioning agents shall assure the owner in the commissioning report that the latest software version.
3. If the specifications include both heat pump and heat recovery outdoor models, the manufacturer shall provide the most recent generation equipment only. Old stock or obsolete models will not be accepted. Products purchased over the internet and not from the manufacturer’s authorized local mechanical representative or authorized distributer will not be accepted.

4. The outdoor unit refrigeration circuit at a minimum shall include the following components:
   a. Refrigerant strainer(s)
   b. Check valve(s)
   c. Inverter driven, high pressure shell compressor.
   d. Oil separator
   e. Accumulator/receiver
   f. 4-way reversing valve
   g. Electronic expansion valve(s)
   h. Double spiral tube sub-cooler and EEV
   i. High/low Schrader valve service ports with caps
   j. High/low service valves
   k. Threaded fusible plug.
   l. High pressure switch
5. The VRF outdoor unit shall use the sub-cooler while operating in cooling mode to sub-cool liquid refrigerant coming from the condenser coil well below saturation temperature to ensure that refrigerant remains in 100% liquid state when it reaches the farthest indoor unit's EEV valve. The amount of sub-cooling shall be modified by the microprocessor controller and minimized at all times to maximize efficiency by not overcooling the liquid.
6. Third Party Controls platform Integration
   a. The VRF system manufacturer's central controls platform shall be able to communicate with third party building management systems (BMS) via BACnet IP, Modbus TCP, or LonWorks™ protocol allowing third party BMS system control and/or monitoring of the LG air conditioning and heating system. See controls specification for more detailed description of integration and points to be controlled and monitored.
   b. The VRF system manufacturer shall have available off-the shelf devices that allows on/off binary interfaces between third party ancillary devices such as fans, door locks, photo eyes, key card switches, motion sensors, exhaust fans, dampers, and a single (or group of) VRF indoor units. Indoor units shall have the ability to start/stop the third-party device, receive a contact closure signal from the third party device, or have the third party device change the operating conditions of the VRF indoor unit. Operating conditions shall include one or more of the following indoor unit functions: fan speed, fan on/off, thermal on/off cooling or heating, or indoor unit start/stop.
7. Wi-Fi communication:
   a. The outdoor unit shall be Wi-Fi–capable. Wi-Fi shall allow service or maintenance personal access to the operating system diagnostics and monitoring functions, via the manufacturer's provided maintenance and diagnostic software over a mobile device or personal computer. Communication between devices shall include: 1) Real-time system operation monitoring with the ability to capture all system operating data for a field determined period of time into a downloadable csv file format to a wireless connected device; 2) Collection of point in time (snapshot) information including all current outdoor unit operating conditions and each indoor unit, system EEV and solenoid valves, sensors, compressor speed, and refrigerant operating pressures. Systems that require computers with a hard wire only connection or other devices to collect, review or record operating conditions shall not be allowed.
8. Microprocessor Control

   a) Factory installed microprocessor control in the outdoor unit, heat recovery unit(s), and indoor unit(s) shall communicate using the same protocol. Translators of any kind are not allowed. Communication between VRF system components shall be via field supplied stranded, shielded and twisted wire pair in a RS 485 network configuration. Integrated control system shall perform functions to optimize the operation of the VRF system.

b) Power and communication interruption: The system shall be capable of performing continuous operation when an individual or several indoor units are being serviced; communication wire cut or power to indoor unit is disconnected. Systems that alarm and/or shut down because of a lack of power to any number of indoor units shall not be acceptable or allowed.

c) Main microprocessor shall include human interface capability that provides a visual code that reports systems operation status. If any malfunction occurs, or system is operating with an unstable refrigerant cycle sensors shall report the malfunction to the visual display.

d) Main processor shall provide the commissioning agent the ability to customize the VRF systems operation based on the environment in which it is installed. Customization function to include defrost operation, modifying target superheat, sub-cooling, low pressure and high pressure values , and invoke other algorithms such as smart load control to optimize system operating efficiency.

9. Outdoor unit microprocessor shall have the capability of reporting malfunction and diagnostic codes to remote control devices such as the VRF manufacturer's central controller, Zone controllers, and Building Management System (BMS).
10. Refrigerant Flow Control
    a. The refrigerant cycle operation core logic shall establish and maintain target evaporating temperature (Te) to be constant in cooling mode and condensing temperature (Tc) constant in heating mode and maintain system stable operation while operating compressors across the range of environmental conditions guaranteeing continuous compressor operation. VRF system core logic shall be able to dynamically modify the target evaporator and condenser temperatures to maximize energy savings when system is operating at part load conditions.
    b. Smart Load Control (SLC): Smart load control operation shall enhance energy savings and increase indoor comfort by monitoring the real time ambient temperature, real time weighted mean average building load, and the outdoor relativity humidity (if enabled).
        1) Smart load control shall be field selectable to optimize system operation for project location and building use. Smart Load Control field setting shall select one of three operating algorithms. The commissioning agent shall select at the time of commissioning and can be changed at any other time:
        2) The Smart Load Control available settings shall:
            a) The system shall be influenced by any one of the chosen algorithm.
            b) Off mode: Smart load control algorithm shall be in off mode
            c) Smooth mode: Smart Load control shall maximize energy savings. The rate of temperature change shall be insignificant.
            d) Normal Mode: Smart Load Control shall balance the rate of temperature change with energy consumed.
            e) Peak Mode: Smart Load shall quickly cool/heat the building. The energy consumption shall not be the priority in this mode.
        3) For the first 20 minutes after the initial startup, the Smart Load Control will influence the outdoor unit operation for the chosen algorithm. This operation will be available at every start up.
        4) After 20 minutes of compressor operation
            a) Smart Load control will maintain the chosen logic and system will operate with the same core logic.
        5) Smart Load Control monitors two or three inputs:
            a) Weighted mean average building load
            b) Outdoor ambient dry bulb temperature
            c) Outdoor ambient relative humidity or indoor relative humidity (when enabled)
    c. Enhance Energy Eavings

1) Cooling Mode:
   a) Smart Load Control raises the system target low pressure during off-peak operation.
   b) Raising the operating low pressure shall reduce the compressor lift, reduce compressor's speed and power consumption.
2) Heating Mode
   a) Smart Load control shall lower the system target high pressure during off-peak heating operation.
   b) Lowering the operating high-pressure target shall reduce compressor lift, reduce compressor speed and power consumption.
   c) Energy saved is in addition to the energy savings basic VRF load control provides.

d. Increased Indoor Comfort
   1) Smart Load control shall use one (or two) sensors to measure changing outdoor weather conditions and shall prepare the VRF system to operate under the revised weather conditions. This operation shall be activated before the changed ambient conditions have an impact on indoor units.

11. Field Supplied Refrigerant Piping Design Parameters
   a. The outdoor unit shall be capable of operating at an elevation difference of up to of 164 feet above or 131 feet below the lowest or highest indoor unit respectively without the requirement of field installed sub cooler or other forms of performance enhancing booster devices.
   b. The outdoor unit shall be capable of operating with up to 984 equivalent length feet of interconnecting liquid line refrigerant pipe in the network.
   c. The outdoor unit shall be capable of operating with up to 492 actual feet or 574 equivalent length feet of liquid line refrigerant pipe spanning between outdoor unit and farthest indoor unit.
   d. The elevation difference between the highest and lowest indoor units shall not exceed 49 feet.
   e. The piping system shall be designed with pipe expansion and contraction possibilities in mind. Required expansion devices shall be field designed, supplied and installed based on proper evaluation of the proposed piping design. In addition to these requirements, the piping system installation must conform to the VRF equipment manufacturer's published guidelines.
   f. The installation of pipe hangers, supports, insulation, and in general the methods chosen to attach the pipe system to the structure must allow for expansion and contraction of the piping system and shall not interfere with that movement.

12. Defrost Operations
   a. Heat Pump

      e)The outdoor unit(s) shall be capable of auto defrost operation to melt accumulated frost off the outdoor unit heat exchanger. The defrost cycle control shall monitor the outdoor ambient temperature and outdoor unit heat exchanger surface temperature.

      f) The frequency of operating the defrost cycle shall be determined by the system's ability to maintain sufficient system head pressure to deliver comfortable warm air to the building.

   b. Heat Recovery
      1) The outdoor unit(s) shall be capable of intelligent defrost operation to melt accumulated frost off the outdoor unit heat exchanger. The defrost cycle control shall monitor the outdoor ambient temperature, humidity (if enabled), building load, and outdoor unit heat exchanger surface temperature in real time.

2) The frequency of operating the defrost cycle shall be determined by the system's ability to maintain sufficient system head pressure to deliver comfortable warm air to the building.
3) The intelligent defrost algorithm shall be field selectable at the time of commissioning of the outdoor unit based on anticipated winter weather conditions. Intelligent defrost continuously calculates the dew point of the ambient air using the outdoor unit's temperature and humidity sensors (if enabled) and maintains the outdoor unit's coil surface temperature above the dew point delaying defrost operation while maintaining indoor space temperature.
4) The intelligent defrost algorithm shall provide smart heating that will extend the system's heating operation and reduce the frequency of defrost cycles.

13. Oil Management
    a. The system shall have an oil injection mechanism to ensure a consistent film of oil on all moving compressor parts.
    b. The system shall be provided with a factory installed oil separator at the discharge port of the compressor and designed to separate, condense, and collect oil vapor from the discharge refrigerant gas and return oil to the sump of the compressor. The oil separator shall have no moving parts in the separation chamber.
    c. The system oil return control algorithm shall operate every 8 hours at a minimum, for a 3-minute period. When activated, the algorithm shall operate the system with the reversing valve in the cooling position, open all electronic expansion valves at the indoor unit(s) and raise the compressor speed to flush oil back to the compressor.

D. Cabinet:

1. Galvanized steel and coated with a corrosion-resistant finish.

    a. Coating with documented salt spray test performance of 1000 hours according to ASTM B117 surface scratch test (SST) procedure.

2. Mounting: Manufacturer-designed provisions for field installation.
3. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

E. Compressor and Motor Assembly:

1. One or more positive-displacement, direct-drive and hermetically sealed scroll compressor(s) with inverter drive and turndown to 15 percent of rated capacity.
2. The compressor design shall be of the high-pressure shell scroll type where the internal pressure below the suction valves of the compressor shall be at the same high pressure and high temperature. The motor shall be cooled by high pressure gas at temperatures above saturation conditions and minimize the mixing of refrigerant liquid with oil in the sump. The system shall employ a high-pressure oil return method returning recovered oil from the oil separator directly into the oil sump of the compressor; oil shall not be allowed to return via the suction line. Bearing surfaces are continually coated with oil. The compressor shall employ an Aero-bearing constructed with high lubricity materials increasing operation time in case of low sump oil level. Compressor shall have a nominal operating range from 12Hz to 110 Hz.
3. The compressor(s) shall be wrapped with heat resistant foil faced, sound deadening blanket that covers all exposed surfaces of the compressor. Sound deadening blankets shall be secured in place by use of a Velcro™ tool-less joint sealing system with a minimum of ½" of overlap along all seams. The sound deadening compressor blanket shall be engineered to leave no direct sound path between the outer surface of the body of the compressor and the surrounding environment.

4. The compressor(s) shall be mounted on rubber isolation grommets. Compressor shall ship with removable clamps that secure the compressor in place while transported. The installing contractor shall remove and discard (or optionally adjust the clamps to allow the isolator to properly function) the clamps prior to commissioning the water source unit.
5. Manufacturers' published data shall include sound pressure and sound power levels.
    a. Sound pressure level shall not exceed 57 dB(A) during cooling operation for Heat Pump and Heat Recovery outdoor units when tested in an anechoic chamber under ISO3745 standard. Other testing conditions shall not be allowed.
6. Protection: Integral protection against the following:

    a. High refrigerant pressure.
    b. Low oil level.
    c. High oil temperature.
    d. Thermal and overload.
    e. Voltage fluctuations.
    f. Phase failure and phase reversal.
    g. Short cycling.

7. Speed Control: Variable to automatically maintain refrigerant suction and condensing pressures while varying refrigerant flow to satisfy system cooling and heating loads.
8. Vibration Control: Integral isolation to dampen vibration transmission.
9. Oil management system to ensure safe and proper lubrication over entire operating range.
10. Crankcase heaters with integral control to maintain safe operating temperature.
11. Fusible plug.

F. Condenser Coil Assembly:

1. Plate Fin Coils:

    a. Casing: Aluminum, galvanized, or stainless steel.
    b. Fins: Aluminum or copper, mechanically bonded to tubes, with arrangement required by performance.
    c. Tubes: Copper, of diameter and thickness required by performance.

2. Aluminum Microchannel Coils:

    a. Series of flat tubes containing a series of multiple, parallel-flow microchannels layered between refrigerant header manifolds.
    b. Single- or multiple-pass arrangement.
    c. Construct fins, tubes, and header manifolds of aluminum alloy.

3. Coating: Corrosion resistant.
4. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
5. The outdoor unit coil shall have a minimum of 14 Fins per Inch (FPI).
6. The outdoor unit coil, all indoor units and the interconnecting field provided pipe network shall be field tested to a minimum pressure of 550 psig. Manufacturers that do not specify and/or specify field testing pressures at less than 550 psig shall not be acceptable.

G. Condenser Fan and Motor Assembly:

1. Fan(s): Propeller type.

a. Direct-drive arrangement. direct drive variable speed axial flow fan(s) with a horizontal air discharge. Each fan shall be provided with an independent dedicated Brushless Digitally Controlled (BLDC), variable speed, inverter driven motors.

b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish to match performance indicated for condenser coil.
c. Statically and dynamically balanced.

2. Fan Guards: Removable safety guards complying with OSHA regulations. If using metal materials, coat with corrosion-resistant coating to match performance indicated for condenser coil.
3. Motor(s): Brushless dc or electronically commutated with permanently lubricated bearings and rated for outdoor duty.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Variable speed with a speed range of least 75 percent.
6. Vibration Control: Integral isolation to dampen vibration transmission.

H. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

I. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for unprotected outdoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:

a. Refrigerant suction temperature.
b. Refrigerant discharge temperature.
c. Outdoor air temperature.
d. Refrigerant high pressure.
e. Refrigerant low pressure.
f. Oil level.

4. Features and Functions: Self-diagnostics, time delay, auto-restart, fuse protection, auto operation mode, manual operation mode , night setback control , power consumption display , run test switch equalize run time between multiple same components. Communication: Network communication with indoor units and other outdoor unit(s).
5. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

J. Unit Electrical:

1. Enclosure: Metal, similar to enclosure, and suitable for unprotected outdoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

K. Unit Hardware: Zinc-plated steel, or stainless steel. Coat exposed surfaces with additional corrosion-resistant coating if required to prevent corrosion when exposed to salt spray test for 1000 hours according to ASTM B117.

L. Unit Piping:

1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

M. Wind Load Installations for Outdoor Units
1. Wind load Installation Drawings meet the requirements of the 2017 Florida Building Code, 6th Edition and ASCE Standard 7-2010

N. Seismic Installations
1. Provide OSHPD Special Seismic Certification Preapproval (OSP) documents for certified product list of VRF equipment to be installed in high seismic risk areas. Provide LG supplemental installation documents in conformance with CBC 2013, 2016 and 2019 California Building Code and IBC 2012, 2015 and 2018 International Building Code.

2.10 HEAT RECOVERY CONTROL UNITS (HRCUs)

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

1. Specially designed for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple units that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.

B. Cabinet:

1. Galvanized-steel construction.
2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

D. Refrigeration Assemblies and Specialties:

1. Specially designed by manufacturer for type of VRF HVAC system being installed, either two or three pipe.
2. Each refrigerant branch circuit shall have refrigerant control valve(s) to control refrigerant flow.
3. Spares: Each heat recovery control unit shall include at least one branch circuit port(s) for future use.

4. Each system piping connection upstream of heat recovery unit shall be fitted with an isolation valve to allow for service to any heat recovery control unit in the system without interrupting operation of the system.
5. Each branch circuit connection shall be fitted with an isolation valve and capped service port to allow for service to any individual branch circuit without interrupting operation of the system.

    a. If not available as an integral part of the heat recovery control unit, isolation valves shall be field installed adjacent to the unit pipe connection.

E. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:
4. Features and Functions: Self-diagnostics, fuse protection.
5. Communication: Network communication with indoor units and outdoor unit(s).
6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

F. Unit Electrical:

1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in raceways to comply with NFPA 70.

G. Unit Piping:

1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.11 SYSTEM CONTROLS

A. General Requirements:

1. Network: Indoor units, HRCUs, and outdoor units shall include integral controls and connect through a TIA-485A or manufacturer-selected control network.
2. Network Communication Protocol: Manufacturer proprietary or open control communication between interconnected units.
3. Integration with Building Automation System: ASHRAE 135, BACnet IP and certified by BACnet Testing Lab (BTL), including the following:

a. Ethernet connection via RJ-45 connectors and port with transmission at 100 Mbps or higher.
b. Integration devices shall be connected to local uninterruptible power supply unit(s) to provide at least 5 minutes of battery backup operation after a power loss.
c. Integration shall include control monitoring scheduling change of value notifications.

4. System Description
   a. LG's Multi V™ Controls Network is the integrated controls platform for LG's Multi V™ Variable Refrigerant Flow (VRF) systems. The customizable Multi V™ Controls Network shall be programed for the level of control to as directed by the owner. Provide the controller options for space, central controller as specified and indicated in the schedules. Provide application controllers for third-party equipment control such as radiation valves, and BACnet™ interfaces for integration with Building Management Systems (BMS).

5. Operator Interface:

   a. Operators shall interface with system and unit controls through the following:
      1) Web interface through web browser software.
      2) The Premium Wired Remote Controller - PREMTA000. Refer to the specifications in this section.

   b. Users shall be capable of interface with controllers for indoor units' control to extent privileges are enabled. Refer to the control features of the Remote Controller PREMTBVCO. Refer to the specifications in this section.

B. VRF HVAC System Operator Software for PC:

1. Software offered by VRF HVAC system manufacturer shall provide system operators with the ability to monitor and control VRF HVAC system(s) from a single dedicated Owner-furnished PC.
2. Software shall provide operator with a graphic user interface to allow monitoring and control of multiple central controllers from a single device location through point-and-click mouse exchange.
3. Plan views shall show building plans with location of indoor units and identification superimposed on plans.
4. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
5. Schedules operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Schedules daily, weekly, and annual events.
6. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
7. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
8. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
9. Supports Multiple Languages:English .
10. Supports Imperial and Metric Temperature Units: Fahrenheit or Celsius.
11. Displays service notifications and error codes.
12. Monitors and displays up to 3000 item error history and 10000 item operation history for regular reporting and further archiving.
13. Monitors and displays cumulative operating time of indoor units.
14. Able to disable and enable operation of individual controllers for indoor units.
15. Information displayed on individual controllers shall also be available for display.

16. Information displayed for outdoor units, including refrigerant high and low pressures percent capacity.

C. Central Controllers: (LG AC SMART 5 – PACS5A00)
1. Overview
   a. The LG AC Smart 5 shall be capable of monitoring and control of up to 128 devices including indoor units, or 64 devices and 9 I/O Modules through its touchscreen interface and embedded web browser. The LG AC Smart 5 shall provide multiple energy management schemes and control of third-party equipment when paired with an associated I/O Module. Additionally, the LG AC Smart 5 shall be capable of providing daily, weekly, yearly, and holiday programmable scheduling of Occupied/Unoccupied settings, On/Off, Mode of Operation, set point and fan speed based on the available functions of the connected system.Centralized control for all indoor and outdoor units from a single central controller location.
   b. Include multiple interconnected controllers as required.

3. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
4. Schedule operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.

   a. Sets schedule for daily, weekly, and annual events.
   b. Schedule options available through central controller shall at least include the schedule options of controllers for indoor units.

5. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
6. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
7. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
8. Service diagnostics tool.
9. Able to disable and enable operation of individual controllers for indoor units.
10. Information displayed on individual controllers shall also be available for display through central controller.
11. Information displayed for outdoor units, including refrigerant high and low pressures percent capacity.
12. Multiple RJ-45 ports for direct connection to a local PC and an Ethernet network switch.
13. Operator interface through a backlit, high-resolution color display touch panel and web accessible through standard web browser software.
14. Other General Features.
   a. The LG AC Smart 5 shall communicate to the LG Multi V™ VRF indoor unit via the VRF RS-485 daisy-chain communication protocol.
   b. The LG AC Smart 5 shall communicate to a third-party Building Automation System via BACnet/IP and Modbus TCP.
   c. The LG AC Smart 5 shall have a 10.2” backlit touchscreen LCD display screen.
   d. The LG AC Smart 5 shall have web access with user control.
   e. The LG AC Smart 5 shall be able to generate an operation and error history log with reporting capabilities.
   f. The LG AC Smart 5 shall be able to generate an operational trending report.
   g. The LG AC Smart 5 shall be able to control up to 128 indoor units in a group or as a single zone.
   h. The LG AC Smart 5 shall support two digital input and two digital outputs for device interlock.

i. The LG AC Smart 5 shall have two set point auto changeover.
j. The LG AC Smart 5 shall have occupied/unoccupied set point control.
k. The LG AC Smart 5 shall have remote controller lock (All, Setpoint, Mode, and Fan Speed).
l. The LG AC Smart 5 shall have error e-mail notification.
m. The LG AC Smart 5 shall have visual floor plan navigation.

D. Wired Controllers for Indoor Units: CRC1 REMOTE CONTROLLER: PREMTBVC0
1. Overview:
a. The MultiSITE CRC1 Remote Controller shall be capable of controlling up to 16 indoor units (1 group). The MultiSITE CRC1 Remote Controller shall be capable of monitoring and controlling the group in terms of On/Off, Mode of Operation, Airflow direction, Fan Speed, space temperature, and space temperature Set Point. Additionally, the Remote Controller shall be capable of providing 7-day programmable scheduling of Occupied/Unoccupied settings, On/Off, Mode of operation, Set Point and Fan Speed. Remote Controllers shall be capable of communicating via the BACnet MS/TP protocol and the ability to communicate with wireless sensors.

2. Single controller capable of controlling multiple indoor units as a group.
3. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
4. Multiple Language: English.
5. Temperature Units: Fahrenheit and Celsius.
6. On/Off: Turns indoor unit on or off.
7. Hold: Hold operation settings until hold is released.
8. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
9. Temperature Display: 1-degree increments.
10. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments between.
11. Relative Humidity Display: 1 percent increments.
12. Relative Humidity Set-Point: Adjustable in 1 percent increments between.
13. Fan Speed Setting: Select between available options furnished with the unit.
14. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
15. Seven-day programmable operating schedule with up to eight events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
16. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
17. Occupancy detection.
18. Service Notification Display: "Filter".
19. Service Run Tests: Limit use by service personnel to troubleshoot operation.
20. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
21. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
22. Setting stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
23. Low-voltage power required for controller shall be powered through non-polar connections to indoor unit.
24. Remote Controllers shall be capable of all of the following funtions.
a. Communicate to the VRF indoor unit via the indoor unit remote controller communication bus.
b. Communicate with a BMS using BACnet MS/TP protocol.
c. Ability to communicate with wireless sensors using a ZigBee Pro Wireless Sensor network.
d. A touchscreen, backlit, LCD display with screen saver capability.
e. Support the ability to display or hide user accessible functions from the home screen.

f. Shall have an internal time clock and calendar.
g. Support the creation of five scheduled events per day.
h. Shall be able to create a scheduled event on a single page.
i. Shall be able to provide a summary view of currently applied schedules.
j. Shall be able to display temperature in °F or °C based on user settings and shall be able to be configured in either °F or °C for all functions.
k. Shall support and allow the scheduling of dual Set Point Auto operation in both occupied and unoccupied settings.
l. Shall have configuration menus based on roles: Building Manager, Installer, BMS Configuration and Basic Diagnostics.
m. Shall have a function code search capability.
n. Shall be able to enable or dis-able Auxiliary Heat and Emergency Heat and be able to assign the primary heat source. (Aux heat kit required.)
o. Shall be able to monitor and control up to 16 indoor units as a single group using the Group Control Wiring kit.
p. Shall be able to initiate a Power Cooling Mode if supported by the available functions of the connected system. Retain "Wireless Controllers for Indoor Units" Paragraph below for indoor unit local controllers that are wireless.

Function	Description	Monitor	Control
On/Off	On/Off operation for group	X	X
Mode of Operation	Mode of Operation for group (Heat/Cool/Fan/Auto/Power Cool)	X	X
Set Point	Space temperature setpoint for group. Setting temperature range 64-84°F depending on operation mode and connected equipment.	X	X
Space Temperature	Display measured space temperature	X	
Fan Speed	Select fan speeds Low-Medium-High-Auto	X	X
Airflow Direction	Select air direction settings Auto/Swing/Fixed	X	X
Lock setting	Ability to lock out operation of the controller	X	X
Filter check	Notification to change dirty filter	X	
Temperature setpoint range limit	Ability to limit heating and cooling setpoint ranges	X	X
Schedule	7-day programmable schedule Maximum of 5 events per day with On/Off, Occ/UnOcc, Mode, Set temperature, and Fan Speed selectable per event.	X	X
Timed Override	Timed override of UnOcc settings	X	X
Occ/UnOcc Setting	Ability to have different settings for both modes	X	X
Operation Time Limit	Limit the run time of an indoor unit	X	X
Auto Changeover Deadband Adjust	Ability to adjust deadband between indoor unit heating and cooling modes	X	X
Set back	Ability to change heating and cooling setpoints	X	X
2 setpoint auto operation	Automatically manage room temperature for heating and cooling	X	
Central Control display	Display if a signal is received from Central Control	X	X

2.12 TWO-STAGE AUXILIARY HEAT CONTROL: PRARH1

A. Overview:
The LG Auxiliary Heater Two Relay Kit shall provide the capabilities to control two additional stages of heat for various applications by using function code setup in the Multi V system.

B. General:
1. The LG Two-Stage Auxiliary Heat Control shall be capable of enabling staging 2 additional stages of back up heat based on demand.
2. The LG Two-Stage Auxiliary Heat Control shall be capable of configuring the order of the heat source (Multi V / auxiliary heat source) so that either can be primary source of heat.
3. Provide reversing relay when used for hot water heating valves that need to fail open.

C. Electrical:
1. Power shall be 24 VAC

2.13 REFRIGERANT AND OIL

A. Refrigerant:

1. As required by VRF HVAC system manufacturer for system to comply with performance requirements indicated.
2. ASHRAE 34, Class A1 refrigerant classification.
3. R-410a.

B. Oil:

1. As required by VRF HVAC system manufacturer and to comply with performance requirements indicated.

2.14 SYSTEM CONDENSATE DRAIN PIPING

A. If more than one material is listed, material selection is Contractor's option.

B. Copper Tubing:

1. Drawn-Temper Tubing: According to Type M or Type DWV according to ASTM B306.
2. Wrought-Copper Fittings: ASME B16.22.
3. Wrought-Copper Unions: ASME B16.22.
4. Solder Filler Metals: ASTM B32, lead-free alloys, and water-flushable flux according to ASTM B813.

2.15 SYSTEM REFRIGERANT PIPING

A. Comply with requirements in Section 232300 "Refrigerant Piping" for system piping requirements.

B. Refrigerant Piping:

1. Copper Tube: ASTM B280, Type ACR.
2. Wrought-Copper Fittings: ASME B16.22.
3. Brazing Filler Metals: AWS A5.8/A5.8M.

C. Refrigerant Tubing Kits:

1. Furnished by VRF HVAC system manufacturer.
2. Factory-rolled and -bundled, soft-copper tubing with tubing termination fittings at each end.
3. Standard one-piece length for connecting to indoor units.
4. Pre-insulated with flexible elastomeric insulation of thickness to comply with governing energy code and sufficient to eliminate condensation.
5. Factory Charge: Dehydrated air or nitrogen.

D. Divided-Flow Specialty Fittings: Where required by VRF HVAC system manufacturer for proper system operation, VRF HVAC system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.

E. Refrigerant Isolation Ball Valves:

1. Description: Uni-body full port design, rated for maximum system temperature and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.
2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
3. Valve Connections: Flare or sweat depending on size.

2.16 METAL HANGERS AND SUPPORTS

A. Copper Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized or copper-coated steel.

2.17 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cooper B-line; brand of Eaton, Electrical Sector.
    b. G-Strut.
    c. Unistrut; Atkore International.

2. Description: Shop- or field-fabricated, pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel for use indoors and of stainless steel for use outdoors.
7. Metallic Coating for Use Indoors: Electroplated zinc, hot-dip galvanized or mill galvanized.
8. Plastic Coating for Use Outdoors: PVC, polyurethane, epoxy or polyester.

2.18 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded, zinc-coated steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated or stainless steel.
2. Outdoor Applications: Stainless steel.

2.19 MISCELLANEOUS SUPPORT MATERIALS

A. Grout: ASTM C1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

B. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.

C. Threaded Rods: Continuously threaded. Zinc-plated steel or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar material as rods.

2.20 PIPING AND TUBING INSULATION

A. Comply with requirements in Section 230719 "HVAC Piping Insulation" for system piping insulation requirements.

B. Condensate Drain Piping and Tubing Insulation and Jacket Requirements:

1. Flexible Elastomeric Insulation:

a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C534, Type I for tubular materials.
b. Indoors: 1/2 inch thick.
c. Outdoors: 1/2 inch thick.

2. Field-Applied Jacket:

a. Concealed: None required.
b. Indoors, Exposed to View: PVC, color selected by engineer, 20 mils thick.
c. Outdoors, Exposed to View: None required.

C. Refrigerant Tubing Insulation and Jacket Requirements:

1. Flexible Elastomeric Insulation:

a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C534, Type I for tubular materials.
b. Indoors: 1 inch thick.
c. Outdoors: 1 inch thick.

2. Field-Applied Jacket:

a. Concealed: None required.
b. Indoors outdoor, Exposed to View: PVC, 20 mils thick.
c. For outdoor application provide UV protective coating as per manufactures requirements.

D. Flexible Elastomeric Insulation Adhesive: Comply with MIL-A-24179A, Type II, Class I.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

F. Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

2.21 SYSTEM CONTROL CABLE

A. Cable Rating: Listed and labeled for application according to NFPA 70.

1. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.

   a. Flame Travel Distance: 60 inches or less.
   b. Peak Optical Smoke Density: 0.5 or less.
   c. Average Optical Smoke Density: 0.15 or less.

2. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
3. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

B. Low-Voltage Control Cabling:

1. Paired Cable: NFPA 70, Type CMG.

   a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
   b. PVC insulation.
   c. Braided or foil shielded.
   d. PVC jacket.
   e. Flame Resistance: Comply with UL 1685.
2. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

   a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
   b. PVC insulation.
   c. Braided or foil shielded.
   d. PVC jacket.
   e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
   f. Flame Resistance: Comply with NFPA 262.

C. TIA-485A Network Cabling:

1. Standard Cable: NFPA 70, Type CMG.

   a. Paired, [one pair] [two pairs], twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
   b. PVC insulation.

c. Unshielded.
d. PVC jacket.
e. Flame Resistance: Comply with UL 1685.

2. Plenum-Rated Cable: NFPA 70, Type CMP.

a. Paired, [one pair] [two pairs], No. 22 AWG, stranded (7x30) tinned-copper conductors.
b. Fluorinated ethylene propylene insulation.
c. Unshielded.
d. Fluorinated ethylene propylene jacket.
e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
f. Flame Resistance: NFPA 262.

D. Ethernet Network Cabling: TIA-568-C.2 Category 6 cable with RJ-45 connectors.

1. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of category cable indicated.
2. Conductors: 100-ohm, 23 AWG solid copper.
3. Shielding: Shielded twisted pairs (FTP).
4. Cable Rating: By application.
5. Jacket: White, Gray, Blue, or yellow thermoplastic.

E. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for control wiring and cable raceways.

2.22 MATERIALS

A. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209.

E. Comply with Section 230546 "Coatings for HVAC" for corrosion-resistant coating.

F. Corrosion-Resistant Coating: Coat with a corrosion-resistant coating capable of withstanding a 3000-hour salt-spray test according to ASTM B117.

1. Standards:

a. ASTM B117 for salt spray.
b. ASTM D2794 for minimum impact resistance of 100 in-lb.
c. ASTM B3359 for cross-hatch adhesion of 5B.

2. Application: Immersion.
3. Thickness: 1 mil.
4. Gloss: Minimum gloss of 60 on a 60-degree meter.

2.23 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect factory-assembled equipment.

B. Equipment will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports for historical record. Submit reports only if requested.

2.24 VIBRATION ISOLATION

A. Floor mounted air handling units shall be mounted on free standing Spring isolators and laterally stable without any housing and complete with a molded neoprene cup or 1/4" neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment and housekeeping pad. Installed and operating heights shall be equal. The ratio of the spring diameter divided by the compressed spring height shall be no less than 0.8. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height. Mountings shall be type SLR, as manufactured by Mason Industries, Inc

B. All suspended air handling units shall use hanger consisting of rigid steel frames containing minimum 1-1/4" thick neoprene elements at the top and a steel spring seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. In order to maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30□ arc from side to side before contacting the cup bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30□ capability. Hangers shall be type PC30N as manufactured by Mason Industries, Inc.

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 products before installation. Reject products that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for piping and tubing to verify actual locations of connections before equipment installation.

D. Examine roughing-in for ductwork to verify actual locations of connections before equipment installation.

E. Examine roughing-in for wiring and conduit to verify actual locations of connections before equipment installation.

F. Examine walls, floors, roofs, and outdoor pads for suitable conditions where equipment will be installed.

G. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION, GENERAL

A. Clearance:

1. Maintain manufacturer's recommended clearances for service and maintenance.
2. Maintain clearances required by governing code.

B. Loose Components: Install components, devices, and accessories furnished by manufacturer, with equipment, that are not factory mounted.

1. Loose components shall be installed by system Installer under supervision of manufacturer's service representative.

3.3 INSTALLATION OF INDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.

B. Unless otherwise required by VRF HVAC system manufacturer, support ceiling-mounted units from structure above using threaded rods; minimum rod size of 3/8 inch.

C. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.

D. Protect finished surfaces of ceilings, floors, and walls that come in direct contact with units. Refinish or replace damaged areas after units are installed.

E. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.

F. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.

G. Provide lateral bracing if needed to limit movement of suspended units to not more than 0.25 inch.

H. For floor- and wall-mounted units that are exposed, conceal piping and tubing, controls, and electrical power serving units within walls.

I. Install floor-mounted units on support structure indicated on Drawings.

J. Attachment: Install hardware for proper attachment to supported equipment.

K. Grouting: Place grout under equipment supports and make bearing surface smooth.

3.4 INSTALLATION OF OUTDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.

B. Install outdoor units on support structures indicated on Drawings.

C. Pad-Mounted Installations: Install outdoor units on cast-in-place concrete equipment bases. Refer to plans and details for concrete pad detail.

1. Attachment: Install anchor bolts to elevations required for proper attachment to supported equipment.
2. Grouting: Place grout under equipment supports and make bearing surface smooth.

3.5 GENERAL REQUIREMENTS FOR PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping and tubing systems. Install piping and tubing as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping and tubing in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping and tubing at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping and tubing above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping and tubing to permit valve servicing.

F. Install piping and tubing at indicated slopes.

G. Install piping and tubing free of sags.

H. Install fittings for changes in direction and branch connections.

I. Install piping and tubing to allow application of insulation.

J. Install groups of pipes and tubing parallel to each other, spaced to permit applying insulation with service access between insulated piping and tubing.

3.6 INSTALLATION OF SYSTEM CONDENSATE DRAIN PIPING

A. General Requirements for Drain Piping and Tubing:

1. Install a union in piping at each threaded unit connection.
2. Install an adjustable stainless-steel hose clamp with adjustable gear operator on unit hose connections. Tighten clamp to provide a leak-free installation.
3. If required for unit installation, provide a trap assembly in drain piping to prevent air circulated through unit from passing through drain piping. Comply with more stringent of the following:

    a. Details indicated on Drawings.

b. Manufacturer's requirements.
c. Governing codes.
d. In the absence of requirements, comply with requirements of ASHRAE handbooks.

4. Extend drain piping from units with drain connections to drain receptors as indicated on Drawings. If not indicated on Drawings, terminate drain connection at nearest accessible location that is not exposed to view by occupants.
5. Provide each 90-degree change in direction with a Y- or T-fitting. Install a threaded plug connection in the dormant side of fitting or future use as a service cleanout.

B. Gravity Drains:

1. Slope piping from unit connection toward drain termination at a constant slope of not less than one percent.

C. Pumped Drains:

1. If unit condensate pump or lift mechanism is not included with an integral check valve, install a full-size check valve in each branch pipe near unit connection to prevent backflow into unit.

3.7 INSTALLATION OF REFRIGERANT PIPING

A. Refrigerant Tubing Kits:

1. Unroll and straighten tubing to suit installation. Deviations in straightness of exposed tubing shall be unnoticeable to observer.
2. Support tubing using hangers and supports indicated at intervals not to exceed 5 feet. Minimum rod size, 1/4 inch.
3. Prepare tubing ends and make mating connections to provide a pressure tight and leak-free installation.

B. Install refrigerant piping according to ASHRAE 15 and governing codes.

C. Select system components with pressure rating equal to or greater than system operating pressure.

D. Install piping as short and direct as possible, with a minimum number of joints and fittings.

E. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

F. Install refrigerant piping and tubing in protective conduit where installed belowground.

G. Install refrigerant piping and tubing in rigid or flexible conduit in locations where exposed to mechanical damage.

H. Unless otherwise required by VRF HVAC system manufacturer, slope refrigerant piping and tubing as follows:

1. Install horizontal hot-gas discharge piping and tubing with a uniform slope downward away from compressor.

2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps to entrain oil in vertical runs.
4. Liquid lines may be installed level.

I. When brazing, remove or protect components that could be damaged by heat.

J. Before installation, clean piping, tubing, and fittings to cleanliness level required by VRF HVAC system manufacturer.

K. Joint Construction:

1. Ream ends of tubes and remove burrs.
2. Remove scale, slag, dirt, and debris from inside and outside of tube and fittings before assembly.
3. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

    a. Use Type BCuP (copper-phosphorus) alloy for joining copper fittings with copper tubing.
    b. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze.

3.8 INSTALLATION OF METAL HANGERS AND SUPPORTS

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

C. Comply with MFMA-103 for metal framing system selections and applications that are not specified.

D. Fastener System Installation:

1. Install powder-actuated fasteners, for use in lightweight concrete or concrete slabs less than 4 inches thick, in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to the manufacturer’s written instructions.
3. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install lateral bracing with pipe hangers and supports to prevent swaying.

H. Install building attachments within concrete slabs or attach to structural steel.

1. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

K. Piping and Tubing Insulation:

1. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
2. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

L. Horizontal-Piping Hangers and Supports: Install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
3. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
4. Multiple horizontal pipes located indoors may use metal framing systems with split clamp attachment for each pipe in lieu if individual clevis hangers.
5. Pipe stands for horizontal pipes located outdoors.
6. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
7. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

M. Horizontal Piping Hanger Spacing and Rod Size: Install hangers for drawn-temper copper piping with the following maximum horizontal spacing and minimum rod sizes:

1. Sizes through NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

N. Plastic Pipe Hanger and Support Spacing:

1. Space hangers and supports according to pipe manufacturer's written instructions for service conditions.
2. Maximum spacing, 5 feet; minimum rod size, 1/4 inch.

O. Vertical-Piping Clamps: Install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): If longer ends are required for riser clamps.

P. Support vertical runs at roof, at each floor, and at midpoint intervals between floors, not to exceed 10 feet.

Q. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified.

R. Use hangers, supports, and attachments with galvanized coatings unless otherwise indicated.

S. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

T. Trim excess length of continuous-thread hanger and support rods to 1 inch.

U. Hanger-Rod Attachments: Install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

V. Building Attachments: Install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

3.9 INSTALLATION OF PIPING AND TUBING INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Installation to maintain a continuous vapor barrier.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are unavailable, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

E. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 INSTALLATION OF DUCT, ACCESSORIES, AND AIR OUTLETS

A. Where installing ductwork adjacent to equipment, allow space for service and maintenance.

B. Comply with requirements for metal ducts specified in Section 233113 "Metal Ducts."

C. Comply with requirements for air duct accessories specified in Section 233300 "Air Duct Accessories."

3.11 ELECTRICAL INSTALLATION

A. Comply with requirements indicated on Drawings and in applicable Division 26 Sections.

B. To the extent electrical power is required for system equipment, components, and controls, and is not indicated on drawings and addressed in the Specifications, the design for such electrical power shall be delegated to VRF HVAC system provider.

1. Delegated design of electrical power to equipment, components and controls, and associated installation shall be included at no additional cost to Owner.

C. Connect field electrical power source to each separate electrical device requiring field electrical power. Coordinate termination point and connection type with Installer.

D. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

E. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding connections.

F. Install nameplate or acrylic label with self-adhesive back for each electrical connection indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated phenolic layers of black with engraved white letters. Letters at least 1/2 inch high.
2. Locate nameplate or label where easily visible.

G. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or revised in this Section.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
2. Outlet boxes for cables shall be no smaller than 4 inches square by 1-1/2 inches deep with extension ring sized to bring edge of ring to within 1/8 inch of the finished wall surface.
3. Flexible metal conduit shall not be used.

H. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.

I. Install manufactured conduit sweeps and long-radius elbows if possible.

J. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.12 INSTALLATION OF SYSTEM CONTROL CABLE

A. Comply with NECA 1.

B. Installation Method:

1. Install cables in raceways except as follows:

a. Within equipment and associated control enclosures.
b. In accessible ceiling spaces where open cable installation method may be used.
c. In gypsum board partitions where cable may be enclosed within wall cavity.

2. Conceal raceway and cables except in unfinished spaces.

C. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."

3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable.
5. Cables serving a common system may be grouped in a common raceway. Install control cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles or access panels.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals.
15. Do not bend cables in a radius less than 10 times the cable OD.
16. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
17. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.

D. Balanced Twisted-Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Do not untwist balanced twisted-pair cables more than 1/2 inch at the point of termination to maintain cable geometry.

E. Open-Cable Installation:

1. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.
2. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

F. Separation from EMI Sources: Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded cable from potential EMI sources including electrical power wiring and equipment.

3.13 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.14 GROUNDING INSTALLATION

A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

B. For low-voltage control cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.15 IDENTIFICATION

A. Identify system equipment, piping, tubing, and valves. Comply with requirements for identification specified in Section 230553 "Identification for HVAC Piping and Equipment."

B. Identify system electrical and controls components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 230553 "Identification for HVAC Piping and equipment."

1. Identify each control cable on each end and at each terminal with a number-coded identification tag. Each cable shall have a unique tag.

3.16 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage VRF HVAC system manufacturer's service representative to advise and assist installers; witness testing; and observe and inspect components, assemblies, and equipment installations, including controls and connections.

1. Field service shall be performed by a factory-trained and -authorized service representative of VRF HVAC system manufacturer whose primary job responsibilities are to provide direct technical support of its products.

    a. Additional factory-authorized representatives may assist with completion of certain activities only if supervised by the manufacturer’s employee. A factory-authorized representative shall not provide assistance without the manufacturer’s employee supervision.

2. The manufacturer shall provide on-site visits during the course of construction at installation milestones indicated. System Installer shall coordinate each visit in advance to give manufacturer sufficient notice to plan the visit. Provide four meeting as follows:
    a. At approximately 25 percent completion of system(s).
    b. At approximately 50 percent completion of system(s).
    c. At approximately 75 percent completion of system(s).
    d. Final inspection before system startup.

3. Site Visits: Activities for each site visit shall include the following:

    a. Meet with VRF HVAC system Installer to discuss field activities, issues, and suggested methods to result in a successful installation.
    b. Offer technical support to Installer and related trades as related to VRF system(s) being installed.
    c. Review progress of VRF HVAC system(s) installation for strict compliance with manufacturer's requirements.
    d. Advise and if necessary, assist Installer with updating related refrigerant calculations and system documentation.

e. Issue a report for each visit, documenting the visit.

1) Report to include name and contact information of individual making the visit.
2) Date(s) and time frames while on-site.
3) Names and contact information of people meeting with while on-site.
4) Clearly identify and list each separate issue that requires resolution. For each issue, provide a unique identification number, relevant importance, specific location or equipment identification, description of issue, recommended corrective action, and follow-up requirements needed. Include a digital photo for clarification if deemed to be beneficial.

4. Final Inspection before Startup:

a. Before inspection, Installer to provide written request to manufacturer stating the system is fully installed according to manufacturer's requirements and ready for final inspection.
b. All system equipment and operating components shall be inspected. If components are inaccessible for inspection, they shall be made accessible before the final inspection can be completed.
c. The manufacturer shall provide a comprehensive inspection of all equipment and each operating component that comprise the complete system(s). Inspection shall follow a detailed checklist specific to each equipment and operating component.
d. Inspection reports for indoor units shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Controller type and model controlling unit.
13) Controller location.
14) Temperature settings and readings within an acceptable range.
15) Humidity settings and readings within an acceptable range.
16) Condensate removal acceptable.
17) Fan settings and readings within an acceptable range.
18) Unit airflow direction within an acceptable range.
19) If applicable, fan external static pressure setting.
20) Filter type and condition acceptable.
21) Noise level within an acceptable range.
22) Refrigerant piping properly connected and insulated.
23) Condensate drain piping properly connected and insulated.
24) If applicable, ductwork properly connected.
25) If applicable, external interlocks properly connected.
26) Remarks.

e. Inspection reports for outdoor units shall include, but not be limited to, the following:

1) Unit designation on Drawings.

2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Condensate removal acceptable.
13) Noise level within an acceptable range.
14) Refrigerant piping properly connected and insulated.
15) Condensate drain piping properly connected and insulated.
16) Remarks.

f. Inspection reports for indoor, dedicated outdoor air ventilation units shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Controller type and model controlling unit.
13) Controller location.
14) Temperature settings and readings within an acceptable range.
15) Humidity settings and readings within an acceptable range.
16) Condensate removal acceptable.
17) Fan settings and readings within an acceptable range.
18) Fan external static pressure setting.
19) Filter type and condition acceptable.
20) Noise level within an acceptable range.
21) Refrigerant piping properly connected and insulated.
22) Condensate drain piping properly connected and insulated.
23) Automatic dampers properly installed and operating.
24) Ductwork properly connected.
25) If applicable, external interlocks properly connected.
26) Remarks.

g. Inspection reports for energy recovery ventilators shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.

8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Controller type and model controlling unit.
13) Controller location.
14) Temperature settings and readings within an acceptable range.
15) Humidity readings.
16) Condensate removal acceptable.
17) Fan settings and readings within an acceptable range.
18) Fan external static pressure setting.
19) Filter type and condition acceptable.
20) Noise level within an acceptable range.
21) Automatic dampers properly installed and operating.
22) Ductwork properly connected.
23) If applicable, external interlocks properly connected.
24) Remarks.

h. Installer shall provide manufacturer with the requested documentation and technical support during inspection.
i. Installer shall correct observed deficiencies found by the inspection.
j. Upon completing the on-site inspection, manufacturer shall provide a written report with complete documentation describing each inspection step, the result, and any corrective action required.
k. If corrective action is required by Installer that cannot be completed during the same visit, provide additional visits, as required, until deficiencies are resolved and systems are deemed ready for startup.
l. Final report shall indicate the system(s) inspected are installed according to manufacturer's requirements and are ready for startup.

B. Perform the following tests and inspections with the assistance of manufacturer's service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Refrigerant Tubing Positive Pressure Testing:

1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing installation, pressurize tubing systems to a test pressure of not less than 1.5 times VRF HVAC system operating pressure, but not less than 600 psig, using dry nitrogen.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of 24 hours. Allowance for pressure changes attributed to changes in ambient temperature is acceptable.
4. Prepare test report to record the following information for each test:

a. Name of person starting test, company name, phone number, and e-mail address.

b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
c. Detailed description of extent of tubing tested.
d. Date and time at start of test.
e. Test pressure at start of test.
f. Outdoor temperature at start of test.
g. Name of person ending test, company name, phone number, and e-mail address.
h. Date and time at end of test.
i. Test pressure at end of test.
j. Outdoor temperature at end of test.
k. Remarks:

5. Submit test reports for Project record.

D. Refrigerant Tubing Evacuation Testing:

1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing positive-pressure testing, evacuate tubing systems to a pressure of 500 microns.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of one hour(s) with no change.
4. Prepare test report to record the following information for each test:

a. Name of person starting test, company name, phone number, and e-mail address.
b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
c. Detailed description of extent of tubing tested.
d. Date and time at start of test.
e. Test pressure at start of test.
f. Outdoor temperature at start of test.
g. Name of person ending test, company name, phone number, and e-mail address.
h. Date and time at end of test.
i. Test pressure at end of test.
j. Outdoor temperature at end of test.
k. Remarks:

5. Submit test reports for Project record.
6. Upon successful completion of evacuation testing, system shall be charged with refrigerant.

E. System Refrigerant Charge:

1. Using information collected from the refrigerant tubing evacuation testing, system Installer shall consult variable refrigerant system manufacturer to determine the correct system refrigerant charge.
2. Installer shall charge system following VRF HVAC system manufacturer's written instructions.
3. System refrigerant charging shall be witnessed by system manufacturer's representative.
4. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

F. Products will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.17 STARTUP SERVICE

A. Engage a VRF HVAC system manufacturer's service representative to perform system(s) startup service.

1. Service representative shall be a factory-trained and -authorized service representative of VRF HVAC system manufacturer.
2. Complete startup service of each separate system.
3. Complete system startup service according to manufacturer's written instructions.

B. Startup checks shall include, but not be limited to, the following:

1. Check control communications of equipment and each operating component in system(s).
2. Check each indoor unit's response to demand for cooling and heating.
3. Check each indoor unit's response to changes in airflow settings.
4. Check each indoor unit, HRCU, and outdoor unit for proper condensate removal.
5. Check sound levels of each indoor and outdoor unit.

C. Installer shall accompany manufacturer's service representative during startup service and provide manufacturer's service representative with requested documentation and technical support during startup service.

1. Installer shall correct deficiencies found during startup service for reverification.

D. System Operation Report:

1. After completion of startup service, manufacturer shall issue a report for each separate system.
2. Report shall include complete documentation describing each startup check, the result, and any corrective action required.
3. The manufacturer shall electronically record not less than two hours of continuous operation of each system and submit with report for historical reference.

    a. All available system operating parameters shall be included in the information submitted.

E. Witness:

1. Invite engineer Owner to witness startup service procedures.
2. Provide written notice not less than 20 business days before start of startup service.

3.18 ADJUSTING

A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature and humidity set points. Adjust initial airflow settings and discharge airflow patterns.

C. Set field-adjustable switches and circuit-breaker trip ranges according to VRF HVAC system manufacturer's written instructions, and as indicated.

D. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to the Project during other-than-normal occupancy hours for this purpose.

3.19 PROTECTION

A. Protect products from moisture and water damage. Remove and replace products that are wet, moisture damaged, or mold damaged.

B. Protect equipment from physical damage. Replace equipment with physical damage that cannot be repaired to new condition. Observable surface imperfections shall be grounds for removal and replacement.

C. Protect equipment from electrical damage. Replace equipment suffering electrical damage.

D. Cover and seal openings of equipment to keep inside of equipment clean. Do not remove covers until finish work is complete.

3.20 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of system who are trained Installer manufacturer's authorized service representative. Include two service visits for preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper equipment and system operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.21 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

3.22 SEQUENCE OF OPERATION

A. The VRF (VRV) system shall be operated through the manufacturer’s building or system wide controller. AC Smart 5 PACS5A000. The controller shall be programmed so the indoor units are operated in groups. The owner and engineer shall review and approve operating groups. Controller shall be integrated with the existing BMS.

B. Indoor Evaporators: Each indoor unit shall be operated through a programable room thermostat. PREMTBVCO. Each unit shall be arranged to run continuously during occupied hours. Alternatively indoor units can be arranged to cycle during occupied hours. The units are designed for simultaneous heating and cooling operation. The room thermostat shall automatically switch each unit from heating to cooling as required to maintain set point. The thermostat shall also be arranged to modulate fan speed in direct proportion to space load.

Thermostats shall be programed to maintain set point to within +- 2 deg F. Each thermostat shall also be programed to limit set point between 70°-75° F.

C. All dedicated outdoor air ERV units (ERV) shall be arranged to operate during scheduled occupied hours. When the units are off. The outside air intake and exhaust dampers shall be closed. The fan shall be off. Enthalpy wheel and fans shall run continuously when the unit is energized to run. The heating cooling coil shall be arranged to maintain a supply air temperature of neutral at 70 deg F. Provide outside air temperature and humidity sensors. Provide SA temperature sensors. When OA temp drops below set point the DX coil shall be arranged to heat the SA. When OA temp rises above set point the DX coil shall be arranged to cool the SA. The system shall also be arranged to maintain % RH of the SA at a maximum of 50% RH adjustable. When SA RH rises above set point the unit shall active DX cooling and sub cool the SA in order to reduce RH. The air shall reheated by use of modulating hot gas reheat coil. Provide enthalpy controls arranged to allow economizer cycle. Provide defrost controls arranged to operate the defrost cycle as per the manufacturer’s recommendations.

4. FINNED TUBE RADIATION:

D. Radiant heating: Provide a control valve (cv) and room thermostats where indicated on plan set at 72°f (adj.) For each zone of hot water radiation, upon a drop in space temperature below set-point the cv valve shall cycle open. On a rise in space temperature above set point the reverse shall take place. For those zones served by vrf units and ftr, controls shall be arranged to operate the vrf unit and ftr in sequence through the auxiliary heater relay kit provided with the vrf unit. Radiant heat shall be the primary heat source. All control valves positions shall be monitored and indicated on the bms

3.23 DEMONSTRATION

A. Engage a VRF HVAC system manufacturer's employed training instructor or factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain entire system.

B. Instructor:

1. Instructor shall be factory trained and certified by VRF HVAC system manufacturer with current training on the system(s), equipment, and controls that are installed.
2. Instructor's credentials shall be submitted for review by engineer or Owner before scheduling training.
3. Instructor(s) shall have not less than three years of training experience with VRF HVAC system manufacturer and past training experience. Schedule and Duration:

4. Schedule training with Owner at least 20 business days before first training session.
5. Training shall occur before Owner occupancy.
6. Provide two separate 4-hr training sessions.
7. Perform not less than eight total hours of training.

C. Location: Owner shall provide a suitable on-site location to host classroom training.

D. Training Attendance: For record purposes, document training attendees at the start of each new training session. Record attendee's name, signature, phone number, and e-mail address.

E. Training Format: Individual training modules shall include classroom training followed by hands-on field demonstration and training.

F. Training Materials: Provide training materials in electronic format to each attendee.

1. Include instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.
2. Video record each classroom training session and submit an electronic copy to Owner before requesting Owner acceptance of training.

G. Acceptance: Obtain engineer written acceptance that training is complete, and requirements indicated have been satisfied.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cabinet unit heaters with centrifugal fans and hot-water coils.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. DDC: Direct digital control.

C. PTFE: Polytetrafluoroethylene plastic.

D. TFE: Tetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include location and size of each field connection.
4. Include details of anchorages and attachments to structure and to supported equipment.
5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
6. Indicate location and arrangement of piping valves and specialties.
7. Indicate location and arrangement of integral controls.
8. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.

2. Structural members to which cabinet unit heaters will be attached.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.

6. Perimeter moldings for exposed or partially exposed cabinets.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Cabinet Unit-Heater Filters: Furnish one spare filter(s) for each filter installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Airtherm; a Mestek company.
2. Carrier Global Corporation.
3. Dunham-Bush, Inc.
4. IEC (International Environmental Corporation); LSB Industries.
5. INDEECO.
6. Markel Products Company; a subsidiary of TPI Corporation.
7. Marley Engineered Products.
8. QMark; Marley Engineered Products.
9. Trane.

2.2 DESCRIPTION

A. Factory-assembled and -tested unit complying with AHRI 440.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.4 COIL SECTION INSULATION

A. Insulation Materials: ASTM C1071; surfaces exposed to airstream shall have aluminum-foil facing to prevent erosion of glass fibers.

1. Thickness: 1/2 inch (13 mm).
2. Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F (0.037 W/m x K at 24 deg C) mean temperature.
3. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84.
4. Adhesive: Comply with ASTM C916 and with NFPA 90A or NFPA 90B.

B. Insulation Materials: Comply with NFPA 90A or NFPA 90B. Unicellular polyethylene thermal plastic, preformed sheet insulation complying with ASTM C534, Type II, except for density.

1. Thickness: 1/2 inch (13 mm).
2. Thermal Conductivity (k-Value): 0.24 Btu x in./h x sq. ft. at 75 deg F (0.034 W/m x K at 24 deg C) mean temperature.
3. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM C411.
4. Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

2.5 CABINETS

A. Material: Steel with baked-enamel finish with manufacturer's standard paint, in color selected by Architect.
1. Horizontal Unit, Exposed Bottom Panels: Minimum 0.0528-inch- (1.35-mm-) thick galvanized sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.
2. Recessed Flanges: Steel, finished to match cabinet.
3. Control Access Door: Key operated.
4. Extended Piping Compartment: 8-inch- (200-mm-) wide piping end pocket.

2.6 FILTERS

A. Minimum Efficiency Reporting Value: According to ASHRAE 52.2.

B. Material: Pleated cotton-polyester media, MERV 7.

2.7 COILS

A. Hot-Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm) and rated for a minimum working pressure of 200 psig (1378 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain.

2.8 CONTROLS

A. Fan and Motor Board: Removable.

1. Fan: Forward curved, double width, centrifugal, directly connected to motor; thermoplastic or painted-steel wheels and aluminum, painted-steel, or galvanized-steel fan scrolls.
2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
3. Wiring Terminations: Connect motor to chassis wiring with plug connection.

B. Factory, Hot-Water Piping Package: ASTM B88, Type L (ASTM B88M, Type B) copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.

1. Two-way, modulating control valve.
2. Hose Kits: Minimum 400-psig (2758-kPa) working pressure, and operating temperatures from 33 to 211 deg F (0.5 to 99 deg C). Tag hose kits to equipment designations.

    a. Length: 24 inches (600 mm).
    b. Minimum Diameter: Equal to cabinet unit-heater connection size.

3. Two-Piece, Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.
4. Calibrated-Orifice Balancing Valves: Bronze body, ball type, 125-psig (860-kPa) working pressure, 250 deg F (121 deg C) maximum operating temperature; with calibrated orifice or venture, connection for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
5. Automatic Flow-Control Valve: Brass or ferrous-metal body, 300-psig (2068-kPa) working pressure at 250 deg F (121 deg C), with removable, corrosion-resistant, tamperproof, self-cleaning piston spring; factory set to maintain constant indicated flow within plus or minus 10 percent of differential pressure range of 2 to 80 psig (13.8 to 552 kPa).
6. Y-Pattern, Hot-Water Strainers: Cast-iron body (ASTM A126, Class B); 125-psig (860-kPa) minimum working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 (DN 15) threaded pipe and full-port ball valve in strainer drain connection.
7. Wrought-Copper Unions: ASME B16.22.

C. Control devices and operational sequences are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC."

D. Electrical Connection: Factory-wired motors and controls for a single field connection.

2.9 CAPACITIES AND CHARACTERISTICS

A. Cabinet:

1. Horizontal, Fully Recessed:

a. Air Inlet: punched louver.
b. Air Outlet: punched louver.

B. Fan:

1. Airflow: 185 cfm (L/s).
2. Motor Horsepower: 1/15.

C. Heating Capacity:

1. Output: 12,900 Btu/h (kW).
2. Entering-Air Temperature: 70 deg F (deg C).
3. Air-Temperature Rise: 20 deg F (deg C).

D. Hot-Water Heating Coil:

1. Water Flow: 0.84 gpm (L/s).
2. Water-Side Pressure Loss: 0.06 feet wg (kPa).
3. Entering-Water Temperature: 180 deg F (deg C).

E. Filters:

1. Face Area: 1 sq. ft. (sq. m).
2. Thickness: 1 inch (25 mm).

F. Electrical Characteristics for Single-Point Connection:

1. Volts: 120 V.
2. Phase: 1.
3. Hertz: 60.
4. Full-Load Amperes: 0.45 A.
5. Minimum Circuit Ampacity: 0.56 A.
6. Maximum Overcurrent Protection: 15 A.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive cabinet unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping and electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cabinet unit heaters to comply with NFPA 90A.

B. Suspend cabinet unit heaters from structure with elastomeric hangers. Vibration isolators are specified in Section 230548.13 "Vibration Controls for HVAC."

C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

D. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Section 232113 "Hydronic Piping," Section 232116 "Hydronic Piping Specialties," Section 232213 "Steam and Condensate Heating Piping," and Section 232216 "Steam and Condensate Heating Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to cabinet unit heater's factory, hot-water piping package. Install the piping package if shipped loose.

D. Comply with safety requirements in UL 1995.

E. Unless otherwise indicated, install union and gate or ball valve on supply-water connection and union and calibrated balancing valve on return-water connection of cabinet unit heater. Hydronic specialties are specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties."

F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

G. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. VFC: Variable frequency controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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. Alpha Wire Company.
2. Belden Inc.
3. Cerro Wire LLC.
4. Encore Wire Corporation.
5. General Cable Technologies Corporation.
6. General Cable; General Cable Corporation.
7. Senator Wire & Cable Company.
8. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2, Type XHHW-2 and Type SO.

D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC mineral-insulated, metal-sheathed cable, Type MI and Type SO with ground wire.

E. VFC Cable:

1. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable.

2. Type TC-ER with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire, and sunlight- and oil-resistant outer PVC jacket.

2.2 CONNECTORS AND SPLICES

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. 3M.
2. AFC Cable Systems, Inc.
3. Gardner Bender.
4. Hubbell Power Systems, Inc.
5. Ideal Industries, Inc.
6. ILSCO.
7. NSi Industries LLC.
8. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
9. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway or Mineral-insulated, metal-sheathed cable, Type MI.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway, Metal-clad cable, Type MC or Mineral-insulated, metal-sheathed cable, Type MI.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway or Metal-clad cable, Type MC.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

I. VFC Output Circuits: Type TC-ER cable with braided shield.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

    a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    b. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

B. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency and testing agency's field supervisor.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

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. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. Galvan Industries, Inc.; Electrical Products Division, LLC.
4. Harger Lightning & Grounding.
5. ILSCO.
6. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
7. Siemens Power Transmission & Distribution, Inc.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors' level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

E. Metallic Fences: Comply with requirements of IEEE C2.

1. Grounding Conductor: Bare, tinned copper, not less than No. 8 AWG.
2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least two rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Manhole Grounds: 10 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 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 the following:

a. Hangers.
b. Steel slotted support systems.
c. Trapeze hangers.
d. Clamps.
e. Turnbuckles.
f. Sockets.
g. Eye nuts.
h. Saddles.
i. Brackets.

2. Include rated capacities and furnished specialties and accessories.

B. Delegated-Design Submittal: For hangers and supports for electrical systems.

1. Include design calculations and details of trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation, A Member of the ABB Group.
f. Unistrut; an Atkore International company.

2. Material: Galvanized steel.
3. Channel Width: 1-5/8 inches.
4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

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) Hilti, Inc.
2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

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) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti, Inc.
4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Surface raceways
5. Boxes, enclosures, and cabinets.
6. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

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. AFC Cable Systems, Inc.
2. Allied Tube & Conduit.
3. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
4. Republic Conduit.
5. Southwire Company.
6. Thomas & Betts Corporation, A Member of the ABB Group.
7. Western Tube and Conduit Corporation.
8. Wheatland Tube Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. FMC: Comply with UL 1; zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

    a. Material: Steel or die cast.
    b. Type: Compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

I. Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

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. AFC Cable Systems, Inc.
2. Arnco Corporation.
3. CANTEX INC.
4. CertainTeed Corporation.
5. Kraloy.
6. RACO; Hubbell.
7. Thomas & Betts Corporation, A Member of the ABB Group.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

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. Cooper B-Line, Inc.; a division of Cooper Industries.

2. Hoffman; a brand of Pentair Equipment Protection.
3. MonoSystems, Inc.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Hubbell Incorporated; Wiring Device-Kellems.
b. MonoSystems, Inc.
c. Legrand/Wiremold
d. Panduit

2.5 BOXES, ENCLOSURES, AND CABINETS

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. Cooper Technologies Company.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman; a brand of Pentair Equipment Protection.
5. Hubbell Incorporated.
6. MonoSystems, Inc.
7. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
8. RACO; Hubbell.
9. Thomas & Betts Corporation, A Member of the ABB Group.
10. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Metal Floor Boxes:

1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

I. Box extensions used to accommodate new building finishes shall be of the same material as recessed box.

J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

K. Gangable boxes are allowed.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Armorcast Products Company.
b. Carson Industries LLC.
c. NewBasis.
d. Oldcastle Precast, Inc.
e. Quazite: Hubbell Power Systems, Inc.
f. Synertech Moulded Products.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC.".
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.7 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC or IMC.
2. Concealed Conduit, Aboveground: GRC or IMC.
3. Underground Conduit: RNC, Type EPC-40-PVC or Type EPC-80-PVC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.

3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following:

    a. Loading dock.
    b. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC or IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-footintervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by the Architect for each specific location.
5. Change from RNC, Type EPC-40-PVC to GRC or IMC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

Q. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

T. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

U. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.

X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Y. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

Z. Locate boxes so that cover or plate will not span different building finishes.

AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

CC. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

5. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

    a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
    b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Advance Products & Systems, Inc.
    b. CALPICO, Inc.
    c. Metraflex Company (The).
    d. Pipeline Seal and Insulator, Inc.
    e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Plastic.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. HOLDRITE.

2.4 GROUT

A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

   a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
   b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall, so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical

sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 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 electrical identification products.

B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

B. Raceways and Cables Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

C. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.3 LABELS

A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Champion America.
c. emedco.
d. Grafoplast Wire Markers.
e. LEM Products Inc.
f. Marking Services, Inc.
g. Panduit Corp.
h. Seton Identification Products.

B. Snap-Around Labels for Raceways and Cables Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceways they identify, and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Marking Services, Inc.
c. Panduit Corp.
d. Seton Identification Products.

C. Self-Adhesive Labels:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. A'n D Cable Products.
b. Brady Corporation.

c. Brother International Corporation.
d. emedco.
e. Grafoplast Wire Markers.
f. Ideal Industries, Inc.
g. LEM Products Inc.
h. Marking Services, Inc.
i. Panduit Corp.
j. Seton Identification Products.

2. Preprinted, 3-mil-thick, polyester or vinyl flexible label with acrylic pressure-sensitive adhesive.

   a. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized to fit the cable or raceway diameter, such that the clear shield overlaps the entire printed legend.

3. Polyester or Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

   a. Nominal Size: 3.5-by-5-inch.

4. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
5. Marker for Tags: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

2.4 BANDS AND TUBES:

A. Snap-Around, Color-Coding Bands for Raceways and Cables: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters of raceways or cables they identify, and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Brady Corporation.
   b. Marking Services, Inc.
   c. Panduit Corp.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around cables they identify. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Brady Corporation.
   b. Panduit Corp.

2.5 TAPES AND STENCILS:

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Carlton Industries, LP.
    b. Champion America.
    c. Ideal Industries, Inc.
    d. Marking Services, Inc.
    e. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. emedco.
    d. Marking Services, Inc.

C. Tape and Stencil for Raceways Carrying Circuits 600 V or Less: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. LEM Products Inc.
    b. Marking Services, Inc.
    c. Seton Identification Products.

D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Carlton Industries, LP.
    b. Seton Identification Products.

E. Underground-Line Warning Tape

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Ideal Industries, Inc.
    c. LEM Products Inc.
    d. Marking Services, Inc.
    e. Reef Industries, Inc.

f. Seton Identification Products.

2. Tape:

a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
b. Printing on tape shall be permanent and shall not be damaged by burial operations.
c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

3. Color and Printing:

a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

4. Tag:

a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
b. Width: 3 inches.
c. Overall Thickness: 5 mils.
d. Foil Core Thickness: 0.35 mil.
e. Weight: 28 lb/1000 sq. ft..
f. Tensile according to ASTM D 882: 70 lbf and 4600 psi.

F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.6 Tags

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. emedco.
d. Marking Services, Inc.
e. Seton Identification Products.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. emedco.
    d. Grafoplast Wire Markers.
    e. LEM Products Inc.
    f. Marking Services, Inc.
    g. Panduit Corp.
    h. Seton Identification Products.

C. Write-On Tags:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Carlton Industries, LP.
    b. LEM Products Inc.
    c. Seton Identification Products.
2. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to raceway, conductor, or cable.
3. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.7 Signs

A. Baked-Enamel Signs:

1. Preprinted aluminum signs punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches.

4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Carlton Industries, LP.
    b. Champion America.
    c. emedco.
    d. Marking Services, Inc.

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches.

4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Champion America.
    c. emedco.
    d. Marking Services, Inc.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

    a. For signs up to 20 sq. inches, minimum 1/16-inch-
    b. For signs larger than 20 sq. inches, 1/8 inch thick.
    c. Engraved legend with black letters on white face.
    d. Punched or drilled for mechanical fasteners.
    e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. emedco.
    d. Marking Services, Inc.

2.8 CABLE TIES

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. Ideal Industries, Inc.
2. Marking Services, Inc.
3. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

J. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

K. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

L. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

3.3 IDENTIFICATION SCHEDULE

A. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Snap-around labels. Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.

C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "STANDBY POWER."
2. "POWER."
3. "UPS."

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.

F. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.

G. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive, self-laminating polyester labels with the conductor or cable designation, origin, and destination.

H. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive, self-laminating polyester labels with the conductor designation.

I. Conductors To Be Extended in the Future: Attach marker tape to conductors and list source.

J. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

K. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

L. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

M. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

    a. Power-transfer switches.
    b. Controls with external control power connections.

N. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

O. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

P. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment To Be Labeled:

   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Switchboards.
   e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   f. Emergency system boxes and enclosures.
   g. Enclosed switches.
   h. Enclosed circuit breakers.
   i. Enclosed controllers.
   j. Variable-speed controllers.
   k. Push-button stations.
   l. Power-transfer equipment.
   m. Contractors.
   n. Remote-controlled switches, dimmer modules, and control devices.
   o. Battery-inverter units.
   p. Power-generating units.
   q. Monitoring and control equipment.
   r. UPS equipment.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Time switches.
2. Photoelectric switches.
3. Standalone daylight-harvesting switching and dimming controls.
4. Indoor occupancy and vacancy sensors.
5. Switchbox-mounted occupancy sensors.
6. Digital timer light switches.
7. Extreme temperature occupancy sensors.
8. Outdoor motion sensors.
9. Lighting contactors.
10. Emergency shunt relays.

B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show installation details for the following:

a. Occupancy sensors.
b. Vacancy sensors.

2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media. Provide names, versions, and website addresses for locations of installed software.
3. Device address list.
4. Printout of software application and graphic screens.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of lighting control software.
b. Faulty operation of lighting control devices.

2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCYAND VACANCY SENSORS

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. Leviton Manufacturing Co., Inc.
2. Cooper Industries, Inc.
3. Acuity Brands.

B. General Requirements for Sensors:

1. Wall or Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
2. Dual technology.
3. Integrated power pack.
4. Hardwired connection to switch ; and BAS and lighting control system.
5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Operation:
   a. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

7. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A Sensor is powered from the power pack Wireless.
8. Power: Line voltage.

9. Power Pack: Dry contacts rated for 20-A LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
10. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
12. Bypass Switch: Override the "on" function in case of sensor failure.
13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

C. Dual-Technology Type: Wall or Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 2000 square feet when mounted48 inches above finished floor.

2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

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. Leviton Manufacturing Co., Inc.
2. Cooper Industries, Inc.
3. Acuity Brands.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox, with provisions for connection to BAS using hardwired connection.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
4. Switch Rating: Not less than 800-VA LED load at 120 V, 1200-VA LED load at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor Tag WS1:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2100 sq. ft.
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP, manual "on," automatic "off" or SP, field-selectable automatic "on," or manual "on," automatic "off."
4. Capable of controlling load in three-way application.
5. Voltage: Match the circuit voltage.
6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
7. Concealed, field, "off" time-delay selector at up to 30 minutes.
8. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
10. Color: as specified by architect.
11. Faceplate: Color matched to switch.

2.3 LIGHTING CONTACTORS

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. ASCO Power Technologies, LP; a business of Emerson Network Power.
2. Eaton.
3. General Electric Company.
4. Square D.

B. Description: Electrically operated and electrically held, combination-type lighting contactors with nonfused disconnect, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less THD of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.4 EMERGENCY SHUNT RELAY

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. Lighting Control and Design.
2. WattStopper; a Legrand® Group brand.

B. Description: NC, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.

1. Coil Rating: as specified on drawings.

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SENSOR INSTALLATION

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

C. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 CONTACTOR INSTALLATION

A. Comply with NECA 1.

B. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.4 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 3/4 inch.

C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.8 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.9 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 260943.16 "Addressable-Luminaire Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."

B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

F. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
3. Detail enclosure types, including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

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. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
b. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Flush and Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 4.
c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Height: 84 inches maximum.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
4. Finishes:

a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel.

F. Incoming Mains:

1. Location: Convertible between top and bottom.
2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

G. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

a. Plating shall run entire length of bus.
b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.

3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

I. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

1. Percentage of Future Space Capacity: 20 percent.

J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 POWER PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker or Lugs only.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.
b. Instantaneous magnetic trip element for short circuits.
c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
3. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
4. Subfeed Circuit Breakers: Vertically mounted.
5. MCCB Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Breaker handle indicates tripped status.
c. UL listed for reverse connection without restrictive line or load ratings.
d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.

f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
h. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
i. Multipole units enclosed in a single housing with a single handle.
j. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

C. Circuit breakers installed in existing panelboards shall be UL listed for use in the panelboards in which they are installed.

2.5 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces.

Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NEMA PB 1.1.

D. Equipment Mounting:
   1. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount top of trim 90 inches above finished floor unless otherwise indicated.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

I. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.

J. Mount surface-mounted panelboards to steel slotted supports 1 1/4 inch in depth. Orient steel slotted supports vertically.

K. Install overcurrent protective devices and controllers not already factory installed.

   1. Set field-adjustable, circuit-breaker trip ranges.
   2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

L. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

M. Install filler plates in unused spaces.

N. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

O. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Perform optional tests. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.

1. Measure loads during period of normal facility operations.
2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. USB charger devices.
3. Twist-locking receptacles.
4. Weather-resistant receptacles.
5. Snap switches.
6. Pendant cord-connector devices.
7. Cord and plug sets.
8. Floor service outlets and poke-through assemblies.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

C. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.8 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. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
2. Poke-Through, Fire-Rated Closure Plugs: One for every five-floor service outlets installed, but no fewer than two.

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. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
2. Hubbell Incorporated; Wiring Device-Kellems.
3. Leviton Manufacturing Co., Inc.
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

2.3 USB CHARGER DEVICES

A. Tamper-Resistant, USB Charger Receptacles: 12 V dc, 2.0 A, USB Type A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 1310, and FS W-C-596.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Eaton (Arrow Hart).
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
3. USB Receptacles: Dual, Type A.
4. Line Voltage Receptacles: Dual, two pole, three wire, and self-grounding.

2.4 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration as indicated on drawings, and UL 498.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
    b. Hubbell Incorporated; Wiring Device-Kellems.
    c. Leviton Manufacturing Co., Inc.
    d. Pass & Seymour/Legrand (Pass & Seymour).

2.5 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.6 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 DECORATOR-STYLE DEVICES

A. Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
    b. Hubbell Incorporated; Wiring Device-Kellems.
    c. Leviton Manufacturing Co., Inc.
    d. Pass & Seymour/Legrand (Pass & Seymour).

B. GFCI, Feed-Through Type, Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and UL 943 Class A.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.

b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

C. GFCI, Weather-Resistant Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and UL 943 Class A.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Pass & Seymour/Legrand (Pass & Seymour).

D. Toggle Switches, Square Face, 120/277 V, 20 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

E. Lighted Toggle Switches, Square Face, 120 V, 20 A: Comply with NEMA WD 1 and UL 20.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: With neon-lighted handle, illuminated when switch is "off."

F. All branch circuits rated at 15 amperes shall only have receptacles rated at 15 amperes connected to it.

2.8 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.9 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, solid brass with satin finish.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

2.10 POKE-THROUGH ASSEMBLIES

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. Hubbell Incorporated; Wiring Device-Kellems.
2. Pass & Seymour/Legrand (Pass & Seymour).
3. Square D; by Schneider Electric.
4. Thomas & Betts Corporation, A Member of the ABB Group.
5. Wiremold / Legrand.

B. Description:

1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
2. Comply with UL 514 scrub water exclusion requirements.
3. Service-Outlet Assembly: Pedestal type with services indicated.
4. Size: Selected to fit nominal 3-inch cored holes in floor and matched to floor thickness.
5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
6. Closure Plug: Arranged to close unused 3-inch cored openings and reestablish fire rating of floor.
7. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables.

2.11 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.

3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600 V ac and less for use in the following:

a. Control circuits.
b. Switchboards.
c. Enclosed controllers.
d. Enclosed switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles. Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Coordination charts and tables and related data.
3. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017700 "Closeout Procedures," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Coordination charts and tables and related data.

1.5 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.6 FIELD CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann; a division of Cooper Industries.
2. Edison; a brand of Cooper Bussmann; a division of Cooper Industries.
3. Littelfuse, Inc.
4. Mersen USA.

B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
2. Type CC: 600-V, zero- to 30-A rating, 200 kAIC, fast acting.
3. Type J: 600-V, zero- to 600-A rating, 200 kAIC.
4. Type L: 600-V, 601- to 6000-A rating, 200 kAIC, time delay.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Service Entrance: Class L, time delay.
2. Feeders: Class RK1, time delay.
3. Motor Branch Circuits: Class RK1, time delay.
4. Power Electronics Circuits: Class J, high speed.
5. Other Branch Circuits: Class J, fast acting.
6. Control Transformer Circuits: Class CC, time delay, control transformer duty.
7. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.10 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Siemens Industry, Inc.
4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.
6. Service-Rated Switches: Labeled for use as service equipment.
7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Siemens Industry, Inc.
4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.
5. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 4.
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.

b. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project.

a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of luminaire.

C. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

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. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. Recessed Fixtures: Comply with NEMA LE 4.

D. Bulb shape complying with ANSI C79.1.

E. Lamp base complying with ANSI C81.61 or IEC 60061-1.

F. Rated lamp life of 35,000 hours.

G. Lamps dimmable from 100 percent to 0 percent of maximum light output.

H. Internal driver.

I. Nominal Operating Voltage: As indicated on Plans.

1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

J. Housings:

1. Extruded-aluminum housing and heat sink.
2. powder-coat finish.

2.2 DOWNLIGHT

A. See Plans for manufacturers.

B. Minimum 1,000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Universal mounting bracket.

D. Integral junction box with conduit fittings.

2.3 LINEAR INDUSTRIAL

A. See Plans for manufacturers.

B. Minimum 5,000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Housing and heat sink rated to the following:
1. NEMA 4X.
2. IP 54.
3. IP 66.
4. Marine and wet locations.
5. CSA C22.2 No 137.

2.4 RECESSED LINEAR

A. See Plans for manufacturers.

B. Minimum 2,000 lumens. Minimum allowable efficacy of 85 lumens per watt.

C. Integral junction box with conduit fittings.

2.5 STRIP LIGHT

A. See Plans for manufacturers.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.6 SURFACE MOUNT, LINEAR

A. See Plans for manufacturers.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.7 SURFACE MOUNT, NONLINEAR

A. See Plans for manufacturers.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.8 SUSPENDED, LINEAR

A. See Plans for manufacturers.

B. Minimum 2,000 lumens. Minimum allowable efficacy of 85 lumens per watt.

2.9 SUSPENDED, NONLINEAR

A. See Plans for manufacturers.

B. Minimum 2,000 lumens. Minimum allowable efficacy of 85 lumens per watt.

C. Integral junction box with conduit fittings.

2.10 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. prismatic acrylic
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:

1. Extruded-aluminum housing and heat sink.
2. powder-coat finish.

E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.11 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.12 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

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 roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.

3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with two 5/32-inch-diameter aircraft cable supports adjustable to 120 inches in length.
2. Ceiling mount with pendant mount with 5/32-inch-diameter aircraft cable supports adjustable to 120 inches in length.
3. Ceiling mount with hook mount.

H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Emergency lighting units.
2. Exit signs.
3. Luminaire supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.

1. Include data on features, accessories, and finishes.
2. Include physical description of the unit and dimensions.
3. Battery and charger for light units.
4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.
    a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule:

1. For emergency lighting units. Use same designations indicated on Drawings.
2. For exit signs. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of luminaire.

B. Product Test Reports: For each luminaire for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Sample Warranty: For manufacturer's warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

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. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Luminaire-mounted, emergency battery pack: One for every 20 emergency lighting units. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two year(s) from date of Substantial Completion.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Power Unit Batteries: 5 years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.
2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Comply with UL 1598 for fluorescent luminaires.

F. Lamp Base: Comply with ANSI C81.61 or IEC 60061-1.

G. Bulb Shape: Complying with ANSI C79.1.

H. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast.

1. Emergency Connection: Operate one lamp(s) continuously at an output of 1100 lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
c. Humidity: More than 95 percent (condensing).
d. Altitude: Exceeding 3300 feet.

4. Nightlight Connection: Operate lamp continuously at 40 percent of rated light output.
5. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.

a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

6. Battery: Sealed, maintenance-free, nickel-cadmium type.
7. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
8. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

2.2 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Luminaires:

1. See Plans for manufacturers.

2. Emergency Luminaires: as indicated on Interior Lighting Fixture Schedule, with the following additional features:

a. Operating at nominal voltage of 120 V ac or 277 V ac.
b. Internal emergency power unit.
c. Rated for installation in damp locations, and for sealed and gasketed luminaires in wet locations.

C. Emergency Lighting Unit:

1. See Plans for manufacturers.

2. Emergency Lighting Unit: as indicated on Interior Lighting Fixture Schedule.
3. Operating at nominal voltage of 120 V ac or 277 V ac.
4. Wall with universal junction box adaptor.
5. UV stable thermoplastic housing, rated for damp locations.
6. Two LED lamp heads.
7. Internal emergency power unit.

D. Remote Emergency Lighting Units:

1. See Plans for manufacturers.

2. Emergency Lighting Unit: as indicated on Interior Lighting Fixture Schedule.
3. Operating at nominal voltage of 120 V ac or 277 V ac.
4. Wall with universal junction box adaptor.
5. UV stable thermoplastic housing, rated for damp locations.
6. LED lamp heads.
7. External emergency power unit.

2.3 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. See Plans for manufacturers.
2. Operating at nominal voltage of 120 V ac or 277 V ac.
3. Lamps for AC Operation: Fluorescent, two for each luminaire; 20,000 hours of rated lamp life.
4. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
5. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.
6. Master/Remote Sign Configurations:

    a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply and battery for power connection to remote unit.
    b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.4 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. Prismatic acrylic.
2. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:

1. Extruded aluminum housing and heat sink.
2. powder coat finish.

E. Conduit: Electrical metallic tubing or Flexible metallic conduit, minimum 3/4 inch in diameter.

2.5 METAL FINISHES

A. 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.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire and emergency power unit weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service:

1. Charge emergency power units and batteries minimum of one hour and depress switch to conduct short-duration test.
2. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

3.6 ADJUSTING

A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:

1. Inspect all luminaires. Replace lamps, emergency power units, batteries, signs, or luminaires that are defective.

a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

2. Conduct short-duration tests on all emergency lighting.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.
4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.

a. Manufacturer's Certified Data: Photometric data certified by manufacturer?s laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.

6. Wiring diagrams for power, control, and signal wiring.
7. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For luminaire supports.

1. Include design calculations for luminaire supports.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of the following:

1. Luminaire.

B. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Source quality-control reports.

D. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.

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. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.10 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.11 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures, including luminaire support components.
    b. Faulty operation of luminaires and accessories.
    c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. UL Compliance: Comply with UL 1598 and listed for wet location.

D. Lamp base complying with ANSI C81.61 or IEC 60061-1.

E. Bulb shape complying with ANSI C79.1.

F. CRI of minimum 70. CCT of 4000 K.

G. L70 lamp life of 50,000 hours.

H. Lamps dimmable from 100 percent to 0 percent of maximum light output.

I. Internal driver.

J. Nominal Operating Voltage: 277 V ac.

K. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.

L. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 LUMINAIRE TYPES

A. Area and Site:

1. See Plans for manufacturers.
2. Luminaire Shape: Square.
3. Mounting: Building.
4. Luminaire-Mounting Height: As indicated on architectural plans.
5. Distribution: Type IV.
6. Diffusers and Globes: Prismatic acrylic.
7. Housings:

    a. Extruded-aluminum housing and heat sink.
    b. powder-coat finish.

2.4 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:

1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage and coating.
c. CCT and CRI for all luminaires.

2.5 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. 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.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; 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.

    a. Color: As indicated on plans.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

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 roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Install lamps in each luminaire.

C. Fasten luminaire to structural support.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.

F. Wiring Method: Install cables in raceways. Conceal raceways and cables.

G. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.

H. Coordinate layout and installation of luminaires with other construction.

I. Adjust luminaires that require field adjustment or aiming.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 BOLLARD LUMINAIRE INSTALLATION:

A. Align units for optimum directional alignment of light distribution.

B. Install on concrete base with top 4 inches above finished grade or surface at luminaire location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.5 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):

a. IES LM-5.
b. IES LM-50.
c. IES LM-52.
d. IES LM-64.
e. IES LM-72.

2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

3.9 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Magnetic door holders.
7. Remote annunciator.
8. Addressable interface device.
9. Digital alarm communicator transmitter.
10. Network communications.
11. Fire alarm wire and cable.
12. Identification products.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. HLI: High Level Interface.

D. NICET: National Institute for Certification in Engineering Technologies.

E. PC: Personal computer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.

6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Locate detectors according to manufacturer's written recommendations.

12. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified, fire-alarm technician; Level III minimum.
    c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

1.6 Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:

    a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
    b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
    d. Riser diagram.
    e. Device addresses.
    f. Record copy of site-specific software.
    g. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

        1) Equipment tested.
        2) Frequency of testing of installed components.
        3) Frequency of inspection of installed components.
        4) Requirements and recommendations related to results of maintenance.
        5) Manufacturer's user training manuals.

    h. Manufacturer's required maintenance related to system warranty requirements.
    i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

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. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
3. Smoke Detectors, Heat Detectors, and Carbon Monoxide Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
5. Keys and Tools: One extra set for access to locked or tamper proofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.
8. Provide all necessary hardware and programming to provide the client with 20% spare capacity on all initiating and indicating circuits.
9. Provide as part of the base contract all labor and materials to install ten (10) additional fire alarm devices during construction. The ten (10) fire alarm device can be but not

limited to smoke detector, heat detector, door holder, duct detector, fan shutdown, tamper switches, flow switches, etc. Include all labor and materials including wire, boxes, conduit, terminations, hardware, software, programming and testing.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.10 PROJECT CONDITIONS

A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Owner's written permission.

B. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.11 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.12 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances, including voice evacuation notices.
2. Identify alarm and specific initiating device at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Close smoke dampers in air ducts of designated air-conditioning duct systems.
9. Recall elevators to primary or alternate recall floors.
10. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Carbon monoxide detector.
2. Independent fire-detection and –suppression systems.
3. User disabling of zones or individual devices.
4. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. Voice signal amplifier failure.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
3. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.

F. Signal from carbon monoxide detector shall initiate the following actions:

1. Initiate supervisory signal to system and records at the main panel and remote annunciator.
2. Transmits a (supervisory) carbon monoxide signal to central station.
3. Continuously operate sounder base associated with the carbon monoxide detector.

2.3 FIRE-ALARM CONTROL UNIT

A. Existing to remain: Siemens Cerberus PRO Modular.

B. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.

a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
b. Include a real-time clock for time annotation of events on the event recorder.
c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
d. The FACP shall be listed for connection to a central-station signaling system service.
e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.

2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, three line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class B.
2. Pathway Survivability: Level 0.
3. Install no more than 100 addressable devices on each signaling-line circuit.
4. Serial Interfaces:

    a. One dedicated RS 485 port for central-station operation using point ID DACT.
    b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
    c. One USB port for PC configuration.

E. Notification-Appliance Circuit:

1. FIRE ALARM: Audible appliances shall generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of fire-alarm control unit.
2. FIRE ALARM HORNS: Where applicable, audible horn appliance shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
3. CARBON MONOXIDE ALARM: Audible appliances shall sound in a four-pulse temporal pattern, as defined in NFPA 72, or a constant tone. Carbon monoxide alarm sound shall be different than the fire alarm sound.
4. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

F. Elevator Recall:

1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:

    a. Elevator lobby detectors except the lobby detector on the designated floor.
    b. Smoke detector in elevator machine room.
    c. Smoke detectors in elevator hoistway.

2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.

G. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to the fire-alarm system.

H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values.

I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

J. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of fire-alarm control unit.

1. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711.

a. Allow the application of, and evacuation signal to, indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
b. Programmable tone and message sequence selection.
c. Standard digitally recorded messages for "Evacuation" and "All Clear."
d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of fire-alarm control unit.

2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

K. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals and supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

L. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

M. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. Manufacturers: Subject to compliance with requirements, provide products which are compatible with the existing to remain Siemens Cerberus PRO Modular systems.

B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

2.5 SYSTEM SMOKE DETECTORS

A. Manufacturers: Subject to compliance with requirements, provide products which are compatible with the existing to remain Siemens Cerberus PRO Modular systems.

B. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Multiple levels of detection sensitivity for each sensor.
    b. Sensitivity levels based on time of day.

C. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Each sensor shall have multiple levels of detection sensitivity.
4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

2.6 CARBON MONOXIDE DETECTORS

A. General: Carbon monoxide detector listed for connection to fire-alarm system.

1. Mounting: Adapter plate for outlet box mounting.
2. Testable by introducing test carbon monoxide into the sensing cell.
3. Detector shall provide alarm contacts and trouble contacts.

4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
5. Comply with UL 2075.
6. Locate, mount, and wire according to manufacturer's written instructions.
7. Provide means for addressable connection to fire-alarm system.
8. Test button simulates an alarm condition.
9. Provide with sounder bases for local audio annunciation.

2.7 MULTICRITERIA DETECTORS

A. Mounting: Twist-lock base interchangeable with smoke-detector bases.

B. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Automatically adjusts its sensitivity by means of drift compensation and smoothing algorithms. The detector shall send trouble alarm if it is incapable of compensating for existing conditions.

D. Test button tests all sensors in the detector.

E. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

1. Primary status.
2. Device type.
3. Present sensitivity selected.
4. Sensor range (normal, dirty, etc.).

F. Sensors: The detector shall be comprised of four sensing elements including a smoke sensor, a carbon monoxide sensor, an infrared sensor, and a heat sensor.

1. Smoke sensor shall be photoelectric type as described in "System Smoke Detectors" Article.
2. Carbon monoxide sensor shall be as described in "Carbon Monoxide Detectors" Article.
3. Heat sensor shall be as described in "Heat Detectors" Article.
4. Each sensor shall be separately listed according to requirements for its detector type.

2.8 HEAT DETECTORS

A. Manufacturers: Subject to compliance with requirements, provide products which are compatible with the existing to remain Siemens Cerberus PRO Modular systems.

B. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

C. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.9 NOTIFICATION APPLIANCES

A. Manufacturers: Subject to compliance with requirements, provide products which are compatible with the existing to remain Siemens Cerberus PRO Modular systems.

B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

D. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.

1. Rated Light Output:

a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate:
   a. Fire alarm unit: Factory finished, red with “FIRE” in white letters.
   b. Carbon monoxide unit: Factory finished, white with “CARBON MONOXIDE” in blue letters. Provide with blue lens.

E. Voice/Tone Notification Appliances:

1. Comply with UL 1480.
2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
3. High-Range Units: Rated 2 to 15 W.
4. Low-Range Units: Rated 1 to 2 W.
5. Mounting: Flush.
6. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.10 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnets: Require no more than 3 W to develop 25-lbf holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.

3. Rating: 24-V ac or dc.

B. Material and Finish: Match door hardware.

2.11 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.12 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.

1. Allow the control panel to switch the relay contacts on command.
2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:

1. Operate notification devices.

2.13 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.14 NETWORK COMMUNICATIONS

A. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.

B. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.

2.15 FIRE ALARM WIRE AND CABLE

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. Comtran Corporation.
2. Draka Cableteq USA.
3. Genesis Cable Products; Honeywell International, Inc.
4. Rockbestos-Suprenant Cable Corp.
5. West Penn Wire.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 16 AWG.

1. Twisted shielded pair, NFPA 70, Article 760 for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL listing.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, UL Listed.

1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

E. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated.

F. All conductors and cables run exposed shall be plenum rated.

G. All conductors and cables installed in underground conduits shall be listed for the use.

2.16 IDENTIFICATION PRODUCTS

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. Brady Corporation.
2. HellermannTyton.
3. Kroy LLC.
4. Panduit Corp.

B. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.17 SOURCE QUALITY CONTROL

A. Factory test optical-fiber cables on reels according to TIA-568-C.1.

B. Factory test multimode optical fiber cables according to TIA-526.14-B and TIA-568-C.3.

C. Cable will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the supervising station.
3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing control and monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

C. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

D. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

E. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
5. HVAC: Locate detectors not closer than 60 inches from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

F. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

H. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

I. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.

K. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.3 PATHWAYS

A. Pathways above recessed ceilings and in non-accessible locations may be routed exposed.

1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.

B. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS

A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
1. Smoke dampers in air ducts of designated HVAC duct systems.
2. Magnetically held-open doors.
3. Electronically locked doors and access gates.
4. Alarm-initiating connection to elevator recall system and components.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. VFC: Variable frequency controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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. Alpha Wire Company.
2. Belden Inc.
3. Cerro Wire LLC.
4. Encore Wire Corporation.
5. General Cable Technologies Corporation.
6. General Cable; General Cable Corporation.
7. Senator Wire & Cable Company.
8. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2, Type XHHW-2 and Type SO.

D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC mineral-insulated, metal-sheathed cable, Type MI and Type SO with ground wire.

E. VFC Cable:

1. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable.

2. Type TC-ER with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire, and sunlight- and oil-resistant outer PVC jacket.

2.2 CONNECTORS AND SPLICES

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. 3M.
2. AFC Cable Systems, Inc.
3. Gardner Bender.
4. Hubbell Power Systems, Inc.
5. Ideal Industries, Inc.
6. ILSCO.
7. NSi Industries LLC.
8. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
9. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway or Mineral-insulated, metal-sheathed cable, Type MI.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway, Metal-clad cable, Type MC or Mineral-insulated, metal-sheathed cable, Type MI.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway or Metal-clad cable, Type MC.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

I. VFC Output Circuits: Type TC-ER cable with braided shield.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

    a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    b. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

B. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency and testing agency's field supervisor.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

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. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. Galvan Industries, Inc.; Electrical Products Division, LLC.
4. Harger Lightning & Grounding.
5. ILSCO.
6. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
7. Siemens Power Transmission & Distribution, Inc.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors' level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

E. Metallic Fences: Comply with requirements of IEEE C2.

1. Grounding Conductor: Bare, tinned copper, not less than No. 8 AWG.
2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least two rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Manhole Grounds: 10 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 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 the following:

a. Hangers.
b. Steel slotted support systems.
c. Trapeze hangers.
d. Clamps.
e. Turnbuckles.
f. Sockets.
g. Eye nuts.
h. Saddles.
i. Brackets.

2. Include rated capacities and furnished specialties and accessories.

B. Delegated-Design Submittal: For hangers and supports for electrical systems.

1. Include design calculations and details of trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation, A Member of the ABB Group.
f. Unistrut; an Atkore International company.

2. Material: Galvanized steel.
3. Channel Width: 1-5/8 inches.
4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

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) Hilti, Inc.
2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

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) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti, Inc.
4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Surface raceways
5. Boxes, enclosures, and cabinets.
6. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

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. AFC Cable Systems, Inc.
2. Allied Tube & Conduit.
3. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
4. Republic Conduit.
5. Southwire Company.
6. Thomas & Betts Corporation, A Member of the ABB Group.
7. Western Tube and Conduit Corporation.
8. Wheatland Tube Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. FMC: Comply with UL 1; zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

    a. Material: Steel or die cast.
    b. Type: Compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

I. Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

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. AFC Cable Systems, Inc.
2. Arnco Corporation.
3. CANTEX INC.
4. CertainTeed Corporation.
5. Kraloy.
6. RACO; Hubbell.
7. Thomas & Betts Corporation, A Member of the ABB Group.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

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. Cooper B-Line, Inc.; a division of Cooper Industries.

2. Hoffman; a brand of Pentair Equipment Protection.
3. MonoSystems, Inc.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Hubbell Incorporated; Wiring Device-Kellems.
b. MonoSystems, Inc.
c. Legrand/Wiremold
d. Panduit

2.5 BOXES, ENCLOSURES, AND CABINETS

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. Cooper Technologies Company.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman; a brand of Pentair Equipment Protection.
5. Hubbell Incorporated.
6. MonoSystems, Inc.
7. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
8. RACO; Hubbell.
9. Thomas & Betts Corporation, A Member of the ABB Group.
10. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Metal Floor Boxes:

1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

I. Box extensions used to accommodate new building finishes shall be of the same material as recessed box.

J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

K. Gangable boxes are allowed.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Armorcast Products Company.
b. Carson Industries LLC.
c. NewBasis.
d. Oldcastle Precast, Inc.
e. Quazite: Hubbell Power Systems, Inc.
f. Synertech Moulded Products.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC.".
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.7 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC or IMC.
2. Concealed Conduit, Aboveground: GRC or IMC.
3. Underground Conduit: RNC, Type EPC-40-PVC or Type EPC-80-PVC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.

3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following:

    a. Loading dock.
    b. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC or IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-footintervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by the Architect for each specific location.
5. Change from RNC, Type EPC-40-PVC to GRC or IMC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

Q. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

T. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

U. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.

X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Y. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

Z. Locate boxes so that cover or plate will not span different building finishes.

AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

CC. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

5. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

    a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
    b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Advance Products & Systems, Inc.
    b. CALPICO, Inc.
    c. Metraflex Company (The).
    d. Pipeline Seal and Insulator, Inc.
    e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Plastic.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. HOLDRITE.

2.4 GROUT

A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

   a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
   b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall, so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical

sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 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 electrical identification products.

B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

B. Raceways and Cables Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

C. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.3 LABELS

A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Champion America.
c. emedco.
d. Grafoplast Wire Markers.
e. LEM Products Inc.
f. Marking Services, Inc.
g. Panduit Corp.
h. Seton Identification Products.

B. Snap-Around Labels for Raceways and Cables Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceways they identify, and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Marking Services, Inc.
c. Panduit Corp.
d. Seton Identification Products.

C. Self-Adhesive Labels:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. A'n D Cable Products.
b. Brady Corporation.

c. Brother International Corporation.
d. emedco.
e. Grafoplast Wire Markers.
f. Ideal Industries, Inc.
g. LEM Products Inc.
h. Marking Services, Inc.
i. Panduit Corp.
j. Seton Identification Products.

2. Preprinted, 3-mil-thick, polyester or vinyl flexible label with acrylic pressure-sensitive adhesive.

   a. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized to fit the cable or raceway diameter, such that the clear shield overlaps the entire printed legend.

3. Polyester or Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

   a. Nominal Size: 3.5-by-5-inch.

4. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
5. Marker for Tags: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

2.4 BANDS AND TUBES:

A. Snap-Around, Color-Coding Bands for Raceways and Cables: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters of raceways or cables they identify, and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Brady Corporation.
   b. Marking Services, Inc.
   c. Panduit Corp.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around cables they identify. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Brady Corporation.
   b. Panduit Corp.

2.5 TAPES AND STENCILS:

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Carlton Industries, LP.
    b. Champion America.
    c. Ideal Industries, Inc.
    d. Marking Services, Inc.
    e. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. emedco.
    d. Marking Services, Inc.

C. Tape and Stencil for Raceways Carrying Circuits 600 V or Less: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. LEM Products Inc.
    b. Marking Services, Inc.
    c. Seton Identification Products.

D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Carlton Industries, LP.
    b. Seton Identification Products.

E. Underground-Line Warning Tape

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Ideal Industries, Inc.
    c. LEM Products Inc.
    d. Marking Services, Inc.
    e. Reef Industries, Inc.

f. Seton Identification Products.

2. Tape:

a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
b. Printing on tape shall be permanent and shall not be damaged by burial operations.
c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

3. Color and Printing:

a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

4. Tag:

a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
b. Width: 3 inches.
c. Overall Thickness: 5 mils.
d. Foil Core Thickness: 0.35 mil.
e. Weight: 28 lb/1000 sq. ft..
f. Tensile according to ASTM D 882: 70 lbf and 4600 psi.

F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.6 Tags

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. emedco.
d. Marking Services, Inc.
e. Seton Identification Products.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. emedco.
    d. Grafoplast Wire Markers.
    e. LEM Products Inc.
    f. Marking Services, Inc.
    g. Panduit Corp.
    h. Seton Identification Products.

C. Write-On Tags:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Carlton Industries, LP.
    b. LEM Products Inc.
    c. Seton Identification Products.
2. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to raceway, conductor, or cable.
3. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.7 Signs

A. Baked-Enamel Signs:

1. Preprinted aluminum signs punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches.

4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Carlton Industries, LP.
    b. Champion America.
    c. emedco.
    d. Marking Services, Inc.

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches.

4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Champion America.
    c. emedco.
    d. Marking Services, Inc.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

    a. For signs up to 20 sq. inches, minimum 1/16-inch-
    b. For signs larger than 20 sq. inches, 1/8 inch thick.
    c. Engraved legend with black letters on white face.
    d. Punched or drilled for mechanical fasteners.
    e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. emedco.
    d. Marking Services, Inc.

2.8 CABLE TIES

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. Ideal Industries, Inc.
2. Marking Services, Inc.
3. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

J. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

K. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

L. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

3.3 IDENTIFICATION SCHEDULE

A. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Snap-around labels. Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.

C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "STANDBY POWER."
2. "POWER."
3. "UPS."

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.

F. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.

G. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive, self-laminating polyester labels with the conductor or cable designation, origin, and destination.

H. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive, self-laminating polyester labels with the conductor designation.

I. Conductors To Be Extended in the Future: Attach marker tape to conductors and list source.

J. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

K. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

L. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

M. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

    a. Power-transfer switches.
    b. Controls with external control power connections.

N. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

O. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

P. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment To Be Labeled:

   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Switchboards.
   e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   f. Emergency system boxes and enclosures.
   g. Enclosed switches.
   h. Enclosed circuit breakers.
   i. Enclosed controllers.
   j. Variable-speed controllers.
   k. Push-button stations.
   l. Power-transfer equipment.
   m. Contractors.
   n. Remote-controlled switches, dimmer modules, and control devices.
   o. Battery-inverter units.
   p. Power-generating units.
   q. Monitoring and control equipment.
   r. UPS equipment.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Time switches.
2. Photoelectric switches.
3. Standalone daylight-harvesting switching and dimming controls.
4. Indoor occupancy and vacancy sensors.
5. Switchbox-mounted occupancy sensors.
6. Digital timer light switches.
7. Extreme temperature occupancy sensors.
8. Outdoor motion sensors.
9. Lighting contactors.
10. Emergency shunt relays.

B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show installation details for the following:

a. Occupancy sensors.
b. Vacancy sensors.

2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media. Provide names, versions, and website addresses for locations of installed software.
3. Device address list.
4. Printout of software application and graphic screens.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of lighting control software.
b. Faulty operation of lighting control devices.

2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCYAND VACANCY SENSORS

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. Leviton Manufacturing Co., Inc.
2. Cooper Industries, Inc.
3. Acuity Brands.

B. General Requirements for Sensors:

1. Wall or Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
2. Dual technology.
3. Integrated power pack.
4. Hardwired connection to switch ; and BAS and lighting control system.
5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Operation:
   a. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

7. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A Sensor is powered from the power pack Wireless.
8. Power: Line voltage.

9. Power Pack: Dry contacts rated for 20-A LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
10. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
12. Bypass Switch: Override the "on" function in case of sensor failure.
13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

C. Dual-Technology Type: Wall or Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 2000 square feet when mounted48 inches above finished floor.

2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

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. Leviton Manufacturing Co., Inc.
2. Cooper Industries, Inc.
3. Acuity Brands.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox, with provisions for connection to BAS using hardwired connection.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
4. Switch Rating: Not less than 800-VA LED load at 120 V, 1200-VA LED load at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor Tag WS1:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2100 sq. ft.
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP, manual "on," automatic "off" or SP, field-selectable automatic "on," or manual "on," automatic "off."
4. Capable of controlling load in three-way application.
5. Voltage: Match the circuit voltage.
6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
7. Concealed, field, "off" time-delay selector at up to 30 minutes.
8. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
10. Color: as specified by architect.
11. Faceplate: Color matched to switch.

2.3 LIGHTING CONTACTORS

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. ASCO Power Technologies, LP; a business of Emerson Network Power.
2. Eaton.
3. General Electric Company.
4. Square D.

B. Description: Electrically operated and electrically held, combination-type lighting contactors with nonfused disconnect, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less THD of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.4 EMERGENCY SHUNT RELAY

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. Lighting Control and Design.
2. WattStopper; a Legrand® Group brand.

B. Description: NC, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.

1. Coil Rating: as specified on drawings.

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SENSOR INSTALLATION

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

C. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 CONTACTOR INSTALLATION

A. Comply with NECA 1.

B. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.4 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 3/4 inch.

C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.8 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.9 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 260943.16 "Addressable-Luminaire Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."

B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

F. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
3. Detail enclosure types, including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

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. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
b. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Flush and Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 4.
c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Height: 84 inches maximum.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
4. Finishes:

a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel.

F. Incoming Mains:

1. Location: Convertible between top and bottom.
2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

G. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

a. Plating shall run entire length of bus.
b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.

3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

I. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

1. Percentage of Future Space Capacity: 20 percent.

J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 POWER PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker or Lugs only.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.
b. Instantaneous magnetic trip element for short circuits.
c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
3. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
4. Subfeed Circuit Breakers: Vertically mounted.
5. MCCB Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Breaker handle indicates tripped status.
c. UL listed for reverse connection without restrictive line or load ratings.
d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.

f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
h. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
i. Multipole units enclosed in a single housing with a single handle.
j. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

C. Circuit breakers installed in existing panelboards shall be UL listed for use in the panelboards in which they are installed.

2.5 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces.

Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NEMA PB 1.1.

D. Equipment Mounting:
   1. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount top of trim 90 inches above finished floor unless otherwise indicated.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

I. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.

J. Mount surface-mounted panelboards to steel slotted supports 1 1/4 inch in depth. Orient steel slotted supports vertically.

K. Install overcurrent protective devices and controllers not already factory installed.

   1. Set field-adjustable, circuit-breaker trip ranges.
   2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

L. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

M. Install filler plates in unused spaces.

N. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

O. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Perform optional tests. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.

1. Measure loads during period of normal facility operations.
2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. USB charger devices.
3. Twist-locking receptacles.
4. Weather-resistant receptacles.
5. Snap switches.
6. Pendant cord-connector devices.
7. Cord and plug sets.
8. Floor service outlets and poke-through assemblies.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

C. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.8 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. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
2. Poke-Through, Fire-Rated Closure Plugs: One for every five-floor service outlets installed, but no fewer than two.

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. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
2. Hubbell Incorporated; Wiring Device-Kellems.
3. Leviton Manufacturing Co., Inc.
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

2.3 USB CHARGER DEVICES

A. Tamper-Resistant, USB Charger Receptacles: 12 V dc, 2.0 A, USB Type A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 1310, and FS W-C-596.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Eaton (Arrow Hart).
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
3. USB Receptacles: Dual, Type A.
4. Line Voltage Receptacles: Dual, two pole, three wire, and self-grounding.

2.4 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration as indicated on drawings, and UL 498.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
    b. Hubbell Incorporated; Wiring Device-Kellems.
    c. Leviton Manufacturing Co., Inc.
    d. Pass & Seymour/Legrand (Pass & Seymour).

2.5 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.6 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 DECORATOR-STYLE DEVICES

A. Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
    b. Hubbell Incorporated; Wiring Device-Kellems.
    c. Leviton Manufacturing Co., Inc.
    d. Pass & Seymour/Legrand (Pass & Seymour).

B. GFCI, Feed-Through Type, Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and UL 943 Class A.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.

b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

C. GFCI, Weather-Resistant Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and UL 943 Class A.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Pass & Seymour/Legrand (Pass & Seymour).

D. Toggle Switches, Square Face, 120/277 V, 20 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

E. Lighted Toggle Switches, Square Face, 120 V, 20 A: Comply with NEMA WD 1 and UL 20.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: With neon-lighted handle, illuminated when switch is "off."

F. All branch circuits rated at 15 amperes shall only have receptacles rated at 15 amperes connected to it.

2.8 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.9 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, solid brass with satin finish.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

2.10 POKE-THROUGH ASSEMBLIES

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. Hubbell Incorporated; Wiring Device-Kellems.
2. Pass & Seymour/Legrand (Pass & Seymour).
3. Square D; by Schneider Electric.
4. Thomas & Betts Corporation, A Member of the ABB Group.
5. Wiremold / Legrand.

B. Description:

1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
2. Comply with UL 514 scrub water exclusion requirements.
3. Service-Outlet Assembly: Pedestal type with services indicated.
4. Size: Selected to fit nominal 3-inch cored holes in floor and matched to floor thickness.
5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
6. Closure Plug: Arranged to close unused 3-inch cored openings and reestablish fire rating of floor.
7. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables.

2.11 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.

3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600 V ac and less for use in the following:

a. Control circuits.
b. Switchboards.
c. Enclosed controllers.
d. Enclosed switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles. Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Coordination charts and tables and related data.
3. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017700 "Closeout Procedures," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Coordination charts and tables and related data.

1.5 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.6 FIELD CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann; a division of Cooper Industries.
2. Edison; a brand of Cooper Bussmann; a division of Cooper Industries.
3. Littelfuse, Inc.
4. Mersen USA.

B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
2. Type CC: 600-V, zero- to 30-A rating, 200 kAIC, fast acting.
3. Type J: 600-V, zero- to 600-A rating, 200 kAIC.
4. Type L: 600-V, 601- to 6000-A rating, 200 kAIC, time delay.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Service Entrance: Class L, time delay.
2. Feeders: Class RK1, time delay.
3. Motor Branch Circuits: Class RK1, time delay.
4. Power Electronics Circuits: Class J, high speed.
5. Other Branch Circuits: Class J, fast acting.
6. Control Transformer Circuits: Class CC, time delay, control transformer duty.
7. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.10 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Siemens Industry, Inc.
4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.
6. Service-Rated Switches: Labeled for use as service equipment.
7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Siemens Industry, Inc.
4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.
5. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 4.
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.

b. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project.

a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of luminaire.

C. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

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. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. Recessed Fixtures: Comply with NEMA LE 4.

D. Bulb shape complying with ANSI C79.1.

E. Lamp base complying with ANSI C81.61 or IEC 60061-1.

F. Rated lamp life of 35,000 hours.

G. Lamps dimmable from 100 percent to 0 percent of maximum light output.

H. Internal driver.

I. Nominal Operating Voltage: As indicated on Plans.

1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

J. Housings:

1. Extruded-aluminum housing and heat sink.
2. powder-coat finish.

2.2 DOWNLIGHT

A. See Plans for manufacturers.

B. Minimum 1,000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Universal mounting bracket.

D. Integral junction box with conduit fittings.

2.3 LINEAR INDUSTRIAL

A. See Plans for manufacturers.

B. Minimum 5,000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Housing and heat sink rated to the following:
1. NEMA 4X.
2. IP 54.
3. IP 66.
4. Marine and wet locations.
5. CSA C22.2 No 137.

2.4 RECESSED LINEAR

A. See Plans for manufacturers.

B. Minimum 2,000 lumens. Minimum allowable efficacy of 85 lumens per watt.

C. Integral junction box with conduit fittings.

2.5 STRIP LIGHT

A. See Plans for manufacturers.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.6 SURFACE MOUNT, LINEAR

A. See Plans for manufacturers.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.7 SURFACE MOUNT, NONLINEAR

A. See Plans for manufacturers.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.8 SUSPENDED, LINEAR

A. See Plans for manufacturers.

B. Minimum 2,000 lumens. Minimum allowable efficacy of 85 lumens per watt.

2.9 SUSPENDED, NONLINEAR

A. See Plans for manufacturers.

B. Minimum 2,000 lumens. Minimum allowable efficacy of 85 lumens per watt.

C. Integral junction box with conduit fittings.

2.10 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. prismatic acrylic
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:

1. Extruded-aluminum housing and heat sink.
2. powder-coat finish.

E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.11 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.12 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

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 roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.

3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with two 5/32-inch-diameter aircraft cable supports adjustable to 120 inches in length.
2. Ceiling mount with pendant mount with 5/32-inch-diameter aircraft cable supports adjustable to 120 inches in length.
3. Ceiling mount with hook mount.

H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Emergency lighting units.
2. Exit signs.
3. Luminaire supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.

1. Include data on features, accessories, and finishes.
2. Include physical description of the unit and dimensions.
3. Battery and charger for light units.
4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.
    a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule:

1. For emergency lighting units. Use same designations indicated on Drawings.
2. For exit signs. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of luminaire.

B. Product Test Reports: For each luminaire for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Sample Warranty: For manufacturer's warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

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. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Luminaire-mounted, emergency battery pack: One for every 20 emergency lighting units. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two year(s) from date of Substantial Completion.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Power Unit Batteries: 5 years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.
2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Comply with UL 1598 for fluorescent luminaires.

F. Lamp Base: Comply with ANSI C81.61 or IEC 60061-1.

G. Bulb Shape: Complying with ANSI C79.1.

H. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast.

1. Emergency Connection: Operate one lamp(s) continuously at an output of 1100 lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
c. Humidity: More than 95 percent (condensing).
d. Altitude: Exceeding 3300 feet.

4. Nightlight Connection: Operate lamp continuously at 40 percent of rated light output.
5. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.

a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

6. Battery: Sealed, maintenance-free, nickel-cadmium type.
7. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
8. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

2.2 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Luminaires:

1. See Plans for manufacturers.

2. Emergency Luminaires: as indicated on Interior Lighting Fixture Schedule, with the following additional features:

a. Operating at nominal voltage of 120 V ac or 277 V ac.
b. Internal emergency power unit.
c. Rated for installation in damp locations, and for sealed and gasketed luminaires in wet locations.

C. Emergency Lighting Unit:

1. See Plans for manufacturers.

2. Emergency Lighting Unit: as indicated on Interior Lighting Fixture Schedule.
3. Operating at nominal voltage of 120 V ac or 277 V ac.
4. Wall with universal junction box adaptor.
5. UV stable thermoplastic housing, rated for damp locations.
6. Two LED lamp heads.
7. Internal emergency power unit.

D. Remote Emergency Lighting Units:

1. See Plans for manufacturers.

2. Emergency Lighting Unit: as indicated on Interior Lighting Fixture Schedule.
3. Operating at nominal voltage of 120 V ac or 277 V ac.
4. Wall with universal junction box adaptor.
5. UV stable thermoplastic housing, rated for damp locations.
6. LED lamp heads.
7. External emergency power unit.

2.3 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. See Plans for manufacturers.
2. Operating at nominal voltage of 120 V ac or 277 V ac.
3. Lamps for AC Operation: Fluorescent, two for each luminaire; 20,000 hours of rated lamp life.
4. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
5. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.
6. Master/Remote Sign Configurations:

    a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply and battery for power connection to remote unit.
    b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.4 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. Prismatic acrylic.
2. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:

1. Extruded aluminum housing and heat sink.
2. powder coat finish.

E. Conduit: Electrical metallic tubing or Flexible metallic conduit, minimum 3/4 inch in diameter.

2.5 METAL FINISHES

A. 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.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire and emergency power unit weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service:

1. Charge emergency power units and batteries minimum of one hour and depress switch to conduct short-duration test.
2. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

3.6 ADJUSTING

A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:

1. Inspect all luminaires. Replace lamps, emergency power units, batteries, signs, or luminaires that are defective.

a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

2. Conduct short-duration tests on all emergency lighting.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.
4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.

a. Manufacturer's Certified Data: Photometric data certified by manufacturer?s laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.

6. Wiring diagrams for power, control, and signal wiring.
7. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For luminaire supports.

1. Include design calculations for luminaire supports.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of the following:

1. Luminaire.

B. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Source quality-control reports.

D. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.

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. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.10 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.11 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures, including luminaire support components.
    b. Faulty operation of luminaires and accessories.
    c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. UL Compliance: Comply with UL 1598 and listed for wet location.

D. Lamp base complying with ANSI C81.61 or IEC 60061-1.

E. Bulb shape complying with ANSI C79.1.

F. CRI of minimum 70. CCT of 4000 K.

G. L70 lamp life of 50,000 hours.

H. Lamps dimmable from 100 percent to 0 percent of maximum light output.

I. Internal driver.

J. Nominal Operating Voltage: 277 V ac.

K. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.

L. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 LUMINAIRE TYPES

A. Area and Site:

1. See Plans for manufacturers.
2. Luminaire Shape: Square.
3. Mounting: Building.
4. Luminaire-Mounting Height: As indicated on architectural plans.
5. Distribution: Type IV.
6. Diffusers and Globes: Prismatic acrylic.
7. Housings:

    a. Extruded-aluminum housing and heat sink.
    b. powder-coat finish.

2.4 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:

1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage and coating.
c. CCT and CRI for all luminaires.

2.5 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. 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.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; 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.

    a. Color: As indicated on plans.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

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 roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Install lamps in each luminaire.

C. Fasten luminaire to structural support.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.

F. Wiring Method: Install cables in raceways. Conceal raceways and cables.

G. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.

H. Coordinate layout and installation of luminaires with other construction.

I. Adjust luminaires that require field adjustment or aiming.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 BOLLARD LUMINAIRE INSTALLATION:

A. Align units for optimum directional alignment of light distribution.

B. Install on concrete base with top 4 inches above finished grade or surface at luminaire location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.5 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):

a. IES LM-5.
b. IES LM-50.
c. IES LM-52.
d. IES LM-64.
e. IES LM-72.

2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

3.9 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Magnetic door holders.
7. Remote annunciator.
8. Addressable interface device.
9. Digital alarm communicator transmitter.
10. Network communications.
11. Fire alarm wire and cable.
12. Identification products.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. HLI: High Level Interface.

D. NICET: National Institute for Certification in Engineering Technologies.

E. PC: Personal computer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.

6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Locate detectors according to manufacturer's written recommendations.

12. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified, fire-alarm technician; Level III minimum.
    c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

1.6 Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:

    a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
    b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
    d. Riser diagram.
    e. Device addresses.
    f. Record copy of site-specific software.
    g. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

        1) Equipment tested.
        2) Frequency of testing of installed components.
        3) Frequency of inspection of installed components.
        4) Requirements and recommendations related to results of maintenance.
        5) Manufacturer's user training manuals.

    h. Manufacturer's required maintenance related to system warranty requirements.
    i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

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. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
3. Smoke Detectors, Heat Detectors, and Carbon Monoxide Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
5. Keys and Tools: One extra set for access to locked or tamper proofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.
8. Provide all necessary hardware and programming to provide the client with 20% spare capacity on all initiating and indicating circuits.
9. Provide as part of the base contract all labor and materials to install ten (10) additional fire alarm devices during construction. The ten (10) fire alarm device can be but not

limited to smoke detector, heat detector, door holder, duct detector, fan shutdown, tamper switches, flow switches, etc. Include all labor and materials including wire, boxes, conduit, terminations, hardware, software, programming and testing.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.10 PROJECT CONDITIONS

A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Owner's written permission.

B. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.11 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.12 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances, including voice evacuation notices.
2. Identify alarm and specific initiating device at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Close smoke dampers in air ducts of designated air-conditioning duct systems.
9. Recall elevators to primary or alternate recall floors.
10. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Carbon monoxide detector.
2. Independent fire-detection and –suppression systems.
3. User disabling of zones or individual devices.
4. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. Voice signal amplifier failure.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
3. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.

F. Signal from carbon monoxide detector shall initiate the following actions:

1. Initiate supervisory signal to system and records at the main panel and remote annunciator.
2. Transmits a (supervisory) carbon monoxide signal to central station.
3. Continuously operate sounder base associated with the carbon monoxide detector.

2.3 FIRE-ALARM CONTROL UNIT

A. Existing to remain: Siemens Cerberus PRO Modular.

B. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.

a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
b. Include a real-time clock for time annotation of events on the event recorder.
c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
d. The FACP shall be listed for connection to a central-station signaling system service.
e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.

2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, three line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class B.
2. Pathway Survivability: Level 0.
3. Install no more than 100 addressable devices on each signaling-line circuit.
4. Serial Interfaces:

    a. One dedicated RS 485 port for central-station operation using point ID DACT.
    b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
    c. One USB port for PC configuration.

E. Notification-Appliance Circuit:

1. FIRE ALARM: Audible appliances shall generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of fire-alarm control unit.
2. FIRE ALARM HORNS: Where applicable, audible horn appliance shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
3. CARBON MONOXIDE ALARM: Audible appliances shall sound in a four-pulse temporal pattern, as defined in NFPA 72, or a constant tone. Carbon monoxide alarm sound shall be different than the fire alarm sound.
4. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

F. Elevator Recall:

1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:

    a. Elevator lobby detectors except the lobby detector on the designated floor.
    b. Smoke detector in elevator machine room.
    c. Smoke detectors in elevator hoistway.

2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.

G. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to the fire-alarm system.

H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values.

I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

J. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of fire-alarm control unit.

1. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711.

a. Allow the application of, and evacuation signal to, indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
b. Programmable tone and message sequence selection.
c. Standard digitally recorded messages for "Evacuation" and "All Clear."
d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of fire-alarm control unit.

2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

K. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals and supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

L. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

M. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. Manufacturers: Subject to compliance with requirements, provide products which are compatible with the existing to remain Siemens Cerberus PRO Modular systems.

B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

2.5 SYSTEM SMOKE DETECTORS

A. Manufacturers: Subject to compliance with requirements, provide products which are compatible with the existing to remain Siemens Cerberus PRO Modular systems.

B. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Multiple levels of detection sensitivity for each sensor.
    b. Sensitivity levels based on time of day.

C. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Each sensor shall have multiple levels of detection sensitivity.
4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

2.6 CARBON MONOXIDE DETECTORS

A. General: Carbon monoxide detector listed for connection to fire-alarm system.

1. Mounting: Adapter plate for outlet box mounting.
2. Testable by introducing test carbon monoxide into the sensing cell.
3. Detector shall provide alarm contacts and trouble contacts.

4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
5. Comply with UL 2075.
6. Locate, mount, and wire according to manufacturer's written instructions.
7. Provide means for addressable connection to fire-alarm system.
8. Test button simulates an alarm condition.
9. Provide with sounder bases for local audio annunciation.

2.7 MULTICRITERIA DETECTORS

A. Mounting: Twist-lock base interchangeable with smoke-detector bases.

B. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Automatically adjusts its sensitivity by means of drift compensation and smoothing algorithms. The detector shall send trouble alarm if it is incapable of compensating for existing conditions.

D. Test button tests all sensors in the detector.

E. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

1. Primary status.
2. Device type.
3. Present sensitivity selected.
4. Sensor range (normal, dirty, etc.).

F. Sensors: The detector shall be comprised of four sensing elements including a smoke sensor, a carbon monoxide sensor, an infrared sensor, and a heat sensor.

1. Smoke sensor shall be photoelectric type as described in "System Smoke Detectors" Article.
2. Carbon monoxide sensor shall be as described in "Carbon Monoxide Detectors" Article.
3. Heat sensor shall be as described in "Heat Detectors" Article.
4. Each sensor shall be separately listed according to requirements for its detector type.

2.8 HEAT DETECTORS

A. Manufacturers: Subject to compliance with requirements, provide products which are compatible with the existing to remain Siemens Cerberus PRO Modular systems.

B. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

C. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.9 NOTIFICATION APPLIANCES

A. Manufacturers: Subject to compliance with requirements, provide products which are compatible with the existing to remain Siemens Cerberus PRO Modular systems.

B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

D. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.

1. Rated Light Output:

a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate:
   a. Fire alarm unit: Factory finished, red with “FIRE” in white letters.
   b. Carbon monoxide unit: Factory finished, white with “CARBON MONOXIDE” in blue letters. Provide with blue lens.

E. Voice/Tone Notification Appliances:

1. Comply with UL 1480.
2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
3. High-Range Units: Rated 2 to 15 W.
4. Low-Range Units: Rated 1 to 2 W.
5. Mounting: Flush.
6. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.10 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnets: Require no more than 3 W to develop 25-lbf holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.

3. Rating: 24-V ac or dc.

B. Material and Finish: Match door hardware.

2.11 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.12 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.

1. Allow the control panel to switch the relay contacts on command.
2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:

1. Operate notification devices.

2.13 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.14 NETWORK COMMUNICATIONS

A. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.

B. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.

2.15 FIRE ALARM WIRE AND CABLE

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. Comtran Corporation.
2. Draka Cableteq USA.
3. Genesis Cable Products; Honeywell International, Inc.
4. Rockbestos-Suprenant Cable Corp.
5. West Penn Wire.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 16 AWG.

1. Twisted shielded pair, NFPA 70, Article 760 for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL listing.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, UL Listed.

1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

E. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated.

F. All conductors and cables run exposed shall be plenum rated.

G. All conductors and cables installed in underground conduits shall be listed for the use.

2.16 IDENTIFICATION PRODUCTS

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. Brady Corporation.
2. HellermannTyton.
3. Kroy LLC.
4. Panduit Corp.

B. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.17 SOURCE QUALITY CONTROL

A. Factory test optical-fiber cables on reels according to TIA-568-C.1.

B. Factory test multimode optical fiber cables according to TIA-526.14-B and TIA-568-C.3.

C. Cable will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the supervising station.
3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing control and monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

C. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

D. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

E. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
5. HVAC: Locate detectors not closer than 60 inches from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

F. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

H. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

I. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.

K. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.3 PATHWAYS

A. Pathways above recessed ceilings and in non-accessible locations may be routed exposed.

1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.

B. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS

A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
1. Smoke dampers in air ducts of designated HVAC duct systems.
2. Magnetically held-open doors.
3. Electronically locked doors and access gates.
4. Alarm-initiating connection to elevator recall system and components.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION